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ABSTRACT

The main objective of the Goteborg Project on Non-Verbatim Learning was to arrive at a commensurable description of the process and outcome of non-verbatim learning, also referred to as meaningful verbal learning. Such a description was thought to be a necessary presupposition for any explanatory models both in experiments on learning and in the broader context of academic performance. Four papers thought to represent the project's main research activities are presented. The papers are: (1) "Non-Verbatim Learning: Level of Processing and Level of Outcome", by Ference Marton; (2) "Non-Verbatim Learning: Level of Outcome as a Function of Level of Processing. I. Some Effects of Explicit Control", by Lars Owe Dahlgren; (3) "On Non-Verbatim Learning: Level of Outcome as a Function of Level of Processing. II. Some Effects of Anticipated Test Requirements", by Roger Saljo; and (4) "Ways of Learning and Patterns of Study", by Lennart Svensson. (BJG)

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PREFACE

Our research group was invited to present reports from our work to the 1975 Annual Meeting of the American Educational Research Association, held in Washington March 30 - April 3. Our session, entitled THE GÖTEBORG PROJECT ON NON-VERBATIM LEARNING was chaired by Ralph A. Hanson, SWRL Educational Research and Development and the discussants were Richard C. Anderson, University of Illinois and Richard E. Snow, Stanford University.

There is some overlapping between these papers and two reports published earlier in this series (certain sections of Ference Marton's paper are identical with report no 39, and Lars Owe Dahlgren has used examples published previously in report no 41). As the four papers are related to each other and together cover fairly well the main research activities within the project we have decided to publish them as they stand.

The R & D unit of the Office of the Chancellor of the Swedish universities financed our research project and to some extent our visit to the United States. For the latter we also received grants from the Swedish Council for Social Research and the Knut and Alice Wallenberg Foundation.

The order of the papers (and the ordering of the names of the authors) corresponds to the order of the presentations at the AERA meeting, which we believe reflects the interrelationship between the various aspects of our work.

Ference Marton
Lars Owe Dahlgren
Roger Säljö
Lennart Svensson

NON-VERBATIM LEARNING: LEVEL OF PROCESSING AND LEVEL OF OUTCOME

Ference Marton

Our intention is to present some results and some lines of thought arising from a recently completed research project.

One of our goals was to arrive at a description of both process and outcome in non-verbatim learning in similar terms (i.e. to achieve a commensurable description). "Non-verbatim learning" refers to those instances in which the learning task is the grasping of what is signified by the sign. "Sign" denotes in this case a written or spoken discourse. The research reported on here was carried out within the context of higher education, where this type of learning can be assumed to be predominant.

The grasping of what is signified implies gaining access to the meaning of the sign (the discourse). In most cases it seems reasonable to assume the occurrence of qualitative inter-individual variation in the outcome of learning. Meaning acquired through written or spoken language can most probably be expected to vary. There will thus be different answers to the question "what is learned" for different individuals. Instead of a quantitative description of the outcome of learning (for instance as a total number of right answers)in certain cases it might be preferable to describe the variation in the outcome of learning in the qualitative sense, for instance, in terms of the different answers to the question of "what is learned". This means a description of a set of conceptions of "what is signified". These different conceptions can be expected to vary in meaningfulness according as they approximate to "what is signified". This implies a vertical (or depth) dimension in the outcome of learning.

Thinking in terms of variation in meaningfulness has traditionally been more common as regards the process of learning than as regards its outcome. Meaningfulness has, for instance, been emphatically stressed by Max Wertheimer (Wertheimer, 1945) and his student George Katona (Katona, 1940). In his well-known experiements, the latter constrasted two methods of instruction in which the subjects either were taught

the principle underlying the solution of a problem or were taught the actual solution of the problem. In accordance with commonsense psychology, subjects exposed to the former treatment retained what was learned longer and could with greater ease apply what they had learned to other problems similar to the training task.

Recently, learning and memory have been analyzed in terms of depth or levels of processing, i.e. in terms of the different perceptual or semantic strata of the stimuli which are the object of attention. (Anderson, 1970; Craik and Lockhart, 1972).

The meaningfulness (or levels) of processing is usually described in terms of variation between conditions of learning. Since any effect of the conditions of learning on the outcome of learning must presumbly be mediated through an effect on the process of learning, it seems however, reasonable to suppose commensurability between the two different sources of variation, the inter-individual and the situational. In other words, the variation in meaningfulness (or levels) of processing induced by variation in conditions of learning is assumed to be of the same kind as the "natural" variation in meaningfulness of processing between individuals, present even under approximately equal conditions.

Both the process and the outcome of non-verbatim learning should thus, in our opinion, be described in terms of levels (of meaningfulness) related to the distinction between the sign and what is signified.

M E T H O D

Arriving at the above mentioned model of description has been a central issue in all the studies carried out, some of which will be reported in more detail by my colleagues.

We started with some very simple and straightforward studies. In these, subjects read a text under approximately equal conditions and after the reading they were asked to give an oral recall of the text, to answer questions concering their experience of the learning process and to answer questions on the content of the passage. Subsequently long-term retention was studied.

In these and some other similar studies, the subjects (who were university students) were interviewed on how they set about their academic work. An investigation was made of the relationship between the learning process within and outside the experimental setting and the connection between these learning processes and academic performance. (Marton, 1974 a; Svensson, 1975).

Subsequently, in a series of experiments, differences in the level of outcome in non-verbatim learning were studied as a function of experimentally manipulated differences in the level of processing (see for instance Dahlgren, 1975 and Säljö, 1975).

All the studies in this project were carried out as individually administrated sessions in which practically all communication between subject and experimenter was oral. The sessions were recorded and the analyses were carried out on transcripts of these recordings. This means, all told, transcripts of 370 sessions lasting between one and two hours, i.e. of more than 500 hours of speech. The results of our research project thus constitute a summary of about three to four million spoken words.

According to traditional paradigms for research, variables are, so to speak, given and one attempts to ascertain relationships between them. Our research must however, be considered as exploratory, in the sense that its main objective is to arrive at a description of the content of variables.

Our model for describing qualitative variation in the outcome of learning involves a description of the various subjective conceptions of what is signified by the sign. This means that whenever the discourse used or the population from which the subjects are taken is "new" in the context of investigation, this kind of research is necessarily to some extent exploratory.

The qualitative variation in the outcome in the various studies was described in relation to the recall of the passage read, to summary questions (e.g. "Try to summarize the article in one or two sentences. What is the author trying to say, in other words?") or in relation to questions concerning the various phenomena, concepts or principles described in, or underlying, the discourse.

In each of the various studies carried out, after a fairly intensive and time-consuming intuitive analysis of the transcripts, a set of qualitatively different categories of outcome was arrived at. These intuitive analyses resulted in judgement instructions which made explicit the relation of the categories to data by stating the description of categories (levels of outcome) and by exemplification.

The choice of the model of description as regards the process of learning was made in a similar way. The analyses concerned this time the answers to the questions about the subjects' experience of the learning process (e.g. "How did you set about learning?"). A number of positive and negative symptoms were identified. These were subsequently defined and exemplified in form of judgement instructions and finally grouped together in two main levels of processing.

Judgements made on the basis of the instructions were found to be sufficiently reliable, especially as far as the levels of outcome were concerned. As a rule, there was a perfect match between two independent judges in about 80 - 90 % of cases.

R E S U L T S

As should be evident from what has been said above, our starting point was the description of the qualitative variation in the outcome of learning. Such a description must necessarily be based on the experimenter's conception of what is signified i.e. on his interpretation of the intentional content of the discourse (or of various parts of it).

"Intentional content" refers to what the author wants to say about some phenomenon, concept, principle etc. Thus, it implies a certain view of the phenomenon, concept, principle etc treated. In all instances investigated by us, we found a considerable variation in the way in which the intentional content of the discourse (or of various parts of it) was understood (Dahlgren,1975; Marton and Dahlgren,1975; Säljö,1975). In practically all cases, we found that the different conceptions could be ordered as to proximity to the intentional content proper. This means that the categories representing conceptions originating from different subjects were found to be related to each other in a logical way. The basis of this ordering is the simple fact that the different categories (levels of outcome) are more or less fragmentary reflections of the intentional content (what is signified).

The set of categories of conceptions (or levels of outcome) constitutes an outcome space, a structure the basic idea of which differs from the common usage of the term "structure" in psychological contexts. Not referring to a set of relationships between different constituents of a discourse or to different constituents of the individual's conceptual network, "structure" in our case denotes the set of relationships that exist between the different appearences of the same thing (the intentional content).

In order to illustrate this an example will be given from the very first study carried out within the research project.

The passage used in the experiment was a mimeographed newspaper article, written by Professor Urban Dahllöf, a colleague of ours. It consisted of 1.400 words and included three tables. The article was mainly a critique of the approaching curriculum reform for the Swedish universities (UKAS), which aimed at bringing studies more into line with those at the polytechnic institutes through the introduction of set combinations of subjects and stricter regulations as regards duration of studies (termination in the case of unsatisfactory examinations results). The reason for the reform, as expressed by the authorities, was that the examination pass rate of the universities was considerably lower than the roughly 70 % achieved at the polytechnic institutes which was considered acceptable.

The author of the article had, after examining the underlying statistics, divided the university students into subcategories and was thereby able to show that, even though the pass rate was very low in certain categories of students, in others it was as high as, if not higher than, that achieved by technical students.

The blanket approach of the university reform, which would affect all equally, was misguided, the author felt. If the pass rate is to be raised (which was in fact not considered self-evident by the author), one must take selective measures, that is to say one must concentrate on just those groups that have a low pass rate.

After the reading of the text four different conceptions of the intentional content of the passage were identified in the subjects' recall of the text and in their answers to questions on content.

(A)	"SELECTIVE MEASURES"	(measures to be taken only for those groups of students that do not fulfil the necessary requirements)
(B)	"DIFFERENTIAL MEASURES"	(measures to be taken which allow for differences between the various groups).
(C)	"MEASURES"	(measures to be taken)
(D)	'DIFFERENCES"	(differences between groups)

These categories are hierarchically related (level A implies level B, which implies both level C and D) and constitute together <u>the outcome space</u> (cf fig. 1).

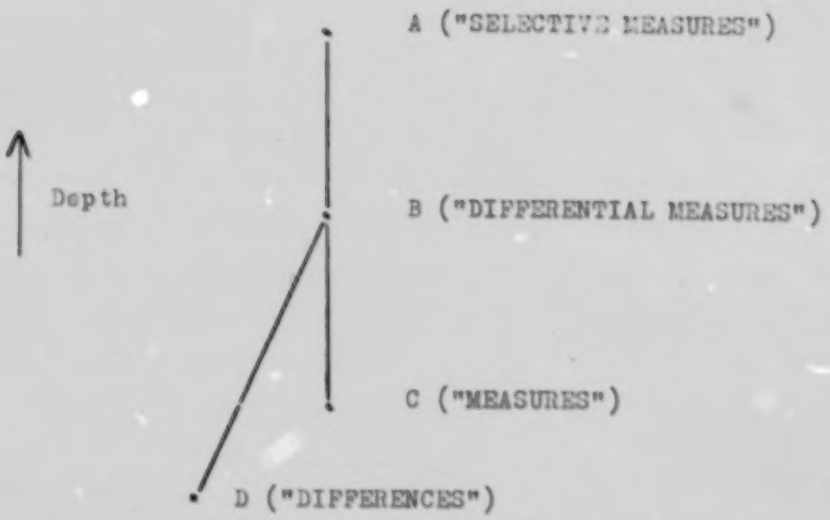

Figure 1.
Graphic illustration of the hierarchy of levels of outcome.

The same categories could be used also in describing the retention of the subjects' conception of the intentional content on the second occasion, roughly five weeks after their having read the text. It is shown in Table 1 that in all but one cases within-subject changes (if any) go from more to less deep levels of outcome (i.e. A → B → C). Since depth is defined in terms of an implicational model this means simply loss of information. As the relative positions of the C and D levels are indeterminate with the implicational model, the line of reasoning here is

reversed since the changes between occasions go from level C to level D we choose to consider C as the deeper level of these two.

Table 1.
Relationship between level of outcome on first and second occasion.

		Second				
		A	B	C	D	Σ
First	A	3	2			5
	B		4	6	1	11
	C			4	4	8
	D			1	5	6
	Σ	3	6	11	10	30

Table 1 illustrates the commensurability of inter- and intra-individual differences. The latter are described in terms of the former since the hierarchy of the levels of outcome has been based on the variation in the conception of the intentional content of the discourse between different subjects. The description of the outcome space which applies to different individuals on a single occasion is taken as a valid description of the outcome space which applies to the same single individuals on different occasions (or under different conditions).

When the intentional content, inherent in the discourse, can be given a mathematical representation, it appears fairly obvious that the difference between levels of outcome is a matter of complexity (i.e. of the number of factors or dimensions involved simultaneously in the conception) (Dahlgren, 1975; Marton and Dahlgren, 1975).

As far as the answers to the introspective questions are concerned, it was found that they could be sorted into categories which are related to each other in a bipolar hierarchical structure which represents the two main <u>levels of processing</u> (both a+ and b+ below are considered as signs of <u>deep-level processing</u> (+) and similarly a- and b- are considered as signs of <u>surface-level processing</u> (-)).

having <u>what is signified</u> (what the discourse is about as the object of focal attention (a+)

implies

active processing, the subject being the agent of learning (b+)

and

having the sign (the discourse itself or the recall of it) as the object of focal attention (a-)

implies

passive processing, the subject not being the agent of learning (b-)

Category a- (having the discourse itself or the recall of it, the sign, as the object of focal attention) appeared most distinct. Fixation to the surface level has elsewhere been shown to covary with weak performance in free recall learning (Marton 1970, pp 83 - 84). This is a case of hyper-intention: in order to be able to recall the text (or the list) some subjects attempt almost literally to transfer it into their heads (cf. Frankl 1963, p. 194 ff.).

As shown in Table 2, level of outcome and level of processing are closely related to each other. The former refers to the model of describing the set of utterances taken as indicators of the subjects' conception of the intentional content of the discourse (what is signified) and the latter refers to the model used in describing the set of utterances in introspective report taken as indicators of whether the sign or what is signified was the object of focal attention during the reading of the text. The relationship between the categories of description is not tautological, however, though the major aim of this study is to describe levels of processing and levels of outcome commensurably.

Table 2.
Relationship between level of processing and level of outcome.

		Level of processing (sign shown)			
		Negative	None	Positive*	Σ
Level of outcome	A			5	5
	B	1	6	4	11
	C	8			8
	D	5	1		6
	Σ	14	7	9	30

* Including one subject showing both positive and negative signs.

As mentioned above, the subjects participating in this experiment also answered questions on how they set about their academic work. The set or utterances considered as indicators of the subject's extra-experimental learning activities and the indicators of the level of processing in the experiment were found to be isomorphic, i.e. the same model of description could be used in both cases. Furthermore, the corresponding set of indicators (process and outcome) within and outside the experiment were significantly related to each other. The process-outcome relationship appeared, as regards academic performance, in the form of a fairly close connection between level of processing and examination results (cf. Marton 1974 a, Svensson 1975).

The categories of description regarding the level of processing in the experiment and the subject's extra-experimental conduct, though considered as structurally identical, differed in "flavour" as to content. For instance, the a+ category, mentioned above was dominated in the latter case by utterances implying the subject's internalization of knowledge (what is learned as a part of oneself).

As mentioned above, we have also carried out a series of experiments in which differences in the outcome of learning were studied as a function of experimentally manipulated differences in the level of processing (e.g. Dahlgren, 1975; Säljö, 1975). One of the main findings from these experiments is that by means of inducing a non-specific deep level processing set the outcome of learning will be improved both in the quali-

tative and in the quantitative sense (cf. Marton, 1974 b; Dahlgren, 1975). On the other hand, when explicit means (such as a adjunct questions) are used to induce deep-level processing, there seems to be a great risk of these means becoming ends in themselves. This will probably result (in contrast to intention) in surface-level processing. The means used to induce deep level processing become the object of focal attention, resulting in a kind of narrow technification of learning, correlated with weak performance (Marton, 1975; Dahlgren, 1975). A partial explanation of these results can possibly be given in terms of the most striking symptom of surface-level processing, mentioned above, namely the so called hyper-intention which means the deleterious effect of too strong an intention on the act intended.

D I S C U S S I O N

Our starting point was the conception of non-verbatim learning as the grasping of what is signified by the sign. The sign is written or spoken language and what is signified is what the discourse is about (i.e. its intentional content). "Levels of outcome" refers to the various appearances of the intentional content. These levels are to be described not in general terms but in terms of the content of learning. Our description of "what is learned" will thus vary with "what is to be learned" (i.e. the learning task).

Our most important conclusion is that the description of the outcome of learning in terms of the various conceptions of its content is the proper level of inquiry in research on non-verbatim learning. There are, at least, two arguments in favour of this conclusion.

First, it seems reasonable to postulate a cognitive system capable of interpreting an infinite number of possible discourses in terms of a finite number of structural invariants. These invariants are thought to underly the differences between the various conceptions of the same phenomena, concepts and principles. We believe that these structural invariants can be found by examining various sets of conceptions (levels of outcome).

Second, even apart from the general aspects of cognition, we believe it worthwhile to describe the outcome space of essential concepts and principles. The various levels of outcome will probably reveal the di-

stinctive features and presuppositions of comprehension. We think it is of interest in its own right to describe what it takes to understand, for instance, the concept of productive resources or the law of diminishing returns (cf. Marton and Dahlgren, 1975).

In research on intellectual development, especially of the Piagetian kind, changes in the interpretation of many concepts and phenomena have been described (see, for instance, Flavell, 1963, especially part two: The experiments, pp. 267-402). The variation investigated has been seen as a function of developmental differences. We have on the other hand studied qualitative variation in form of inter-individual differences representing to what extent the individual manages to penetrate the discourse and grasp what it is about.

The concrete form of our model of description of the outcome of non-verbatim learning is, of course, in each case a function of the researcher's own grasping of what the discourse is about, and his opinion about the terms in which the structure underlying the discourse should be described.

Recently, various efforts have been made to arrive at algorithmic procedures applicable to any discourse in order to make its underlying structure explicit (e.g. Crothers, 1972, Fredriksen, 1972, 1973 and Meyer, 1973). (The term "algorithm" is used in the sense of "... an effective procedure ... a set of rules which tell us, from moment to moment, precisely how to behave" Dreyfus, 1972, p. XV).

There is, however, a close structural homology between research on non-verbatim learning and non-verbatim learning itself. The heart of the matter is the grasping of <u>what is signified</u> by <u>the sign</u>. There are good reasons not to consider non-verbatim learning as an algorithmic procedure.

The same may be said, we believe, of research on this subject.

REFERENCES

Anderson, R.C. Control of student mediating processes during verbal learning and instruction. Review of Educational Research, 1970, 40, 145-170.

Craik, F.M. & Lockhart, R.S. Levels of processing: A framework for memory research. Journal of Verbal Learning and Verbal Behavior, 1972, 11, 671-684.

Crothers, E.J. Memory structure and the recall of discourse. Chapter 10 in J.B. Carroll & R.O. Freedle (Eds.). Language comprehension and the acquisition of knowledge. Washington: Winston, 1972, pp. 247-284.

Dahlgren, L.O. Non-verbatim learning: Level of outcome as a function of level of processing I. Paper presented at this symposium. 1975.

Dreyfus, M.L. What computers can't do, A critique of artificial reason. New York: Harper & Row, 1972.

Flavell, J.H. The developmental psychology of Jean Piaget. Princeton, N.J: Van Norstrand, 1963.

Fredriksen, C.H. Effects of task-induced cognitive operations on comprehension and memory processes. Chapter 9 in J.B. Carrol & R.O. Freedle (Eds.). Language comprehension and the acquisition of knowledge. Washington: Winston, 1972, pp. 211-246.

Fredriksen, C.H. Cognitive aspects of learning in arbitrary and non-arbitrary contexts. Acquisition of knowledge from natural-language discourse. Final report, University of California, Berkely, 1973 (mimeo.).

Katona, G. Organizing and memorizing. New York: Columbia University Press, 1940.

Marton, F. Inlärning och studiefärdighet (Learning and study skills). Rapporter från Pedagogiska institutionen, Göteborgs universitet, nr 121, 1974 (a).

Marton, F. Some effects of content-neutral instructions on non-verbatim learning in a natural setting. Scandinavian Journal of Educational Research, 1974, 18, 199-210 (b).

Marton, F. On non-verbatim learning II.: The erosion effect of a task-induced learning algorith. Reports from the Institute of Education, University of Göteborg, no. 40, 1975.

Marton, F & Dahlgren, L.O. On non-verbatim learning III.: The outcome space of some basic concepts in economics. Reports from the Institute of Education, University of Göteborg, no. 41, 1975.

Meyer, B.I.F. Structure of prose: Identification and effects on memory. Paper presented at the Annual Invitational Interdisciplinary Meeting on Structural Learning, Philadelphia, 1973.

Svensson, L. Ways of learning and patterns of study. Paper presented at this symposium. 1975.

Säljö, R. Non-verbatim learning: Level of outcome as a function of level of processing. II. Paper presented at this symposium. 1975.

Wertheimer, M. Productive thinking. New York: Harper & Row, 1945.

NON-VERBATIM LEARNING: LEVEL OF OUTCOME AS A FUNCTION OF LEVEL OF PROCESSING. I.

Some Effects of Explicit Control

Lars Owe Dahlgren

Control of learning activities are to be regarded as manipulation of attention.

According to the tacit assumptions about the nature of learning and knowledge these manipulations can be undertaken from two different starting-points.

First, there is the quantitative view of knowledge, i.e. knowledge is conceptualized as a mass of units of facts of about equal size and importance, implying that temporal characteristics of the process of learning are the most significant determinant of differences as regards the outcome, i.e. knowledge.

Second, there is the qualitative view of knowledge i.e. that which determines the properties of knowledge is the content of the concepts and principles constituting an individual's knowledge. This view also implies that the most important determinant of the structure of the outcome of learning is the content of the learning activities.

Consequently, the measures for controlling learning that are to be derived from these different outlooks are different in nature.

On the assumption that the level of attention (i.e. the degree of attentional intensity) is approximately equal among subjects and that the quantitative perspective is applied, differences with respect to the outcome of learning may be ascribed to differences as regards what we may call the horizontal distribution of attention throughout the text, i.e. the distribution in the sense of priority given to the topics that taken together make up the material to be learned.

If, on the other hand, the qualitative perspective is applied, the differences between subjects may be ascribed to differences with regard to what might be denoted the vertical distribution of attention.

In this case we are using a within-topic perspective in contrast to the between-topic perspective used in the former case. (A ver-

tical variation in the distribution of attention is only applicable in non-verbatim learning and does not make any sense if used to characterize verbatim learning). The vertical variation of attention alludes to whether

> "the sign or what is signified is the object of focal attention" (Marton, 1975 a).

There is no lawful (or logical) relationship between the sign and its referent (what is signified). Having the sign as the object of focal attention means a surface processing of the material, while focusing on what is signified represents a deep-level processing.

A more thorough description of these learning sets are given in Marton (1974 b) and Svensson (1975).

A manipulation of the horizontal distribution of attention can be produced by different means. The most common method is to use questions as the mechanism for manipulating attention. (A prose passage is prepared by a number of sets of questions being either prospective or retrospective with respect to the text parts they refer to). The main part of the research within this field has been carried out within the mathemagenic tradition (c.f. Rothkopf, 1965, 1966, 1968; Frase, 1967, 1968 a, b, 1970).

The overall result picture from this research is dominated by two main findings, (1) The effects are positive and specific (i.e. limited to yield question-corresponding topics) when a certain distribution of attention is hinted at before reading (i.e. the questions are given before the reading is started) and (2) The effects are positive and general (i.e. not limited to yield question-corresponding topics) when the questions are given after the termination of the reading, i.e. have their effects principally on the subsequent text parts.

The text material used in the investigations referred to are mainly/always of a narrative and non-analytic character. This fact in a sense makes the quantitative measurement of the dependent variable convenial to variations in the learning process required. From this

point of view, there are thus no objections to be raised towards neither the measurement procedure applied nor the measures taken in order to control the distribution of attention.

When it comes to non-verbatim learning however, measures of control must be directed towards the content of the processing of a specific topic. (The horizontal distribution of attention, being secondary to the vertical, is probably automatically influenced if the vertical distribution is successfully modified).

Although very little empirical research along these lines of thought seems to have been carried out, some statements having resemblance to the notion of the vertical dimension are given by R.C. Anderson (1970).

> "While few of the specific techniques for promoting deep processing that have been investigated so far, are likely to have direct pedagogic application, the general implication for education is clear, almost tautological: students will learn most when they are required to understand".
> (ibid p 366)

The next questions of importance are about the form and content of the measures required in order to control the vertical distribution of attention and about the measurement of the dependent variable, the resulting knowledge.

Positive as well as negative effects on the outcome of learning of experimental manipulations have earlier been demonstrated in experiments reported by Marton (1974 a, 1975 b).

In the latter very dramatic negative effects were shown. In this experiment the experimental condition comprised of interruptions after each of the five subsections in the experimental text passage.

On these occasions a number of questions were put to the E-group, for example

> "What sub-sections do you think there are in this section? (Say where they start and finish)".

and

"What is the relationship between the various sub-sections?"

The control subjects were permitted to read the text without any interruptions.

The dependent variable was then measured by a recall of what the chapter was about and 20 questions covering the content. After about two months the subjects were contacted for a delayed retention measurement. As we can see in Table 1 the C-group was fairly superior, and furthermore the difference was preserved on the second occasion (the time for the delayed measurement).

Table 1.
Number of items correct, in retention test.
(Sum values for three independent raters).

	Experimental			Control			
	$\bar{x}$	s	n	$\bar{x}$	s	n	t
Immediate	34.5	8.8	15	45.7	8.5	15	3.41*
Delayed	21.0	5.5	15	30.2	10.5	14	2.81*

* $p < .01$

(Marton, 1975 b, p 8)

To get a better conception of the functional process determinants underlying these differences, Marton (1975 b) carries the analysis one step further with the hypothesis that:

> "The E-groups decidelly weaker result could be explained as a kind of technification of the learning process; the subjects possibly develop a strategy of picking up information that is necessary for answering the (inserted) questions that they know they are going to be asked. A fixation on the specific questions or rather on one of them, may result in their no longer proceeding <u>via</u> the text but rather round it".
> (ibid)

For the analysis of the recalls two distinctions were introduced (a) between just mentioning a topic or describing its content and (b) between erroneous and correct descriptions.

Table 2.
Number of topics in recall.
(Sum values for three independent raters).

	Experimental			Control			
	$\bar{x}$	s	n	$\bar{x}$	s	n	t
No.right	17.7	12.6	15	35.5	10.2	15	4.10*
No.wrong	5.9	4.3	15	6.3	4.2	15	0.21
No.mentioned	12.7	9.2	15	3.1	2.5	15	3.76*

* $p < .001$

(Marton, 1975 b, p 14)

This analysis, as is shown in Table 2, gives even more dramatic differences between the groups.

The hypothesis concerning the earlier mentioned circumvention is thus strongly supported by the data. This mentioning instead of description is called by Marton the erosion effect e.g. the content is eroded and a content-free structure is the only retention of the learning.

Positive effects of experimental manipulations of the learning process by means of content-neutral measures have been found by Rothkopf (1966) and Marton (1974 a). The two experiments, in spite of great differences with regard to the text material and the structure of the test questions show some similarities. Rothkopf (1966) simply instructed one of his groups by exhorting the subjects to read very carefully because the text contained a great many details. In a following test this group performed significantly better than a control group who did not get any instructions at all before reading.

In another experiment (Marton, 1974 a) one group was given a content-

neutral instruction that had a great deal in common with the introduction presented to the experimental group in our study, and thus had as its aim to substantiate the conception of deep-level processing. (The text material in fact was almost identical to our own text, since it comprised the three introductory chapters from Samuelson, 1969).

The experimental subjects were further asked to make a list of key-concepts and important principles to be found in the text. These instructions were not given to the control group. Thereafter the subjects were sent home to read the passage (which was a part of their future course requirement and of which no one had any previous knowledge).

About 10 days after the instructions were given, the subjects returned and eight questions covering the content of the passage were put to them.

The experimental group performed significantly better than the control group in the opinion of two of the three independent judges. The difference obtained by the third judge was substantially the same.

Säljö (1975 a) has studied the effects of more implicit modes of control. Certain parts of his experiment will also be presented.

The purpose of our investigation is twofold. On the one hand we are interested in studying the effects on the vertical distribution of attention of experimental manipulations, where questions are used as the principal measure for control.

On the other hand, differences as regards the vertical distribution of attention cannot be detected by quantitative measures. This fact necessitates a great interest in the <u>content</u> of the outcome of learning. For this reason a great deal of the section giving an account of the results will contain a rather detailed description of the qualitative variation in the various answers given in the retention test.

METHOD

Subjects

Thirty-eight students of sociology at the University of Göteborg participated in the experiment as paid volunteers. Twenty-four of the subjects were females and their ages varied between 18 and 31 year, the median being 20 years.

Text

The text to be read was the first two chapters of a Swedish edition of Samuelson's Economics (Samuelson, 1969). The two chapters comprise 45 pages and 15.000 (6.000 + 9.000) words.

Procedure

The thirty-eight subjects were randomly divided into an experimental (E) and a control (C) group. Every subject was contacted individually and asked whether he/she would take part in the experiment, and a time for the session was agreed upon. The experiment was carried out individually and all communication between subject and experimenter was oral except for some drawings made by the subjects in order to answer the questions in the retention test. The sessions were recorded and all analyses were based on transcripts of these recordings. About 40 days later the subjects were contacted again and a new appointment was agreed upon "for something of the same sort as last time". The interval between the first and second session varied between 43 and 47 days with a median of 45 days.

At the beginning of the first session both groups were instructed to read very carefully. The E group were in addition told to aim at depth and comprehension and the importance of an active set in learning was pointed out. In accordance with this, there were 19 questions written in the margin of Chapter 1 for the E group such as "What does this mean?", "Why is that?", "What does this imply?", "What is the connection between A and B?".

After the instructions had been given, the subject (S) began reading, while the experimenter (E) remained in the room occupied with reading of his own. There was no significant difference in the time it took to read Chapter 1 by the E group and the C group (an average of 76.7 and 66.3 minutes respectively, $t = 1.49$, $p > .05$; $df = 36$). After having read Chapter 1, S was asked five questions as a retention test. Each answer was followed up with a kind of maieutic technique until the correct answer could be agreed upon. After this, S was asked to

read the second chapter "in roughly the same way as the first". In this case all subjects read the original unprepared text; the conditions of learning were thus equal for the E and C groups except for their experimental background. There was no difference of practical or statistical significance between the time taken on reading Chapter 2 for the two groups (an average of 97.8 for the E group and 86.0 minutes for the C group, $t = .21$, $p > .05$, $df = 36$). In order to avoid bias, five questions in the retention test after Chapter 2 were asked by a new experimenter who was ignorant of which group the subjects belonged to. Each question was followed up in the same way as after Chapter 1 until the correct answer could be agreed upon.

The retention test was followed by an interview comprising of introspective questions mainly about the experience of the process of learning in the present setting.

On the second occasion the questions in both retention tests were asked again, followed by an introspective interview, this time principally concerning the process of remembering.

Retention test

The questions after the first chapter were based on five topics, considered as fundamental to the subject (definition of economics, the concept of scarce resources, descriptive v. normative statements, statistical v. causal relationship and "the fallacy of composition"). As far as the E group was concerned, each topic had been pointed out in the course of reading by means of questions in the margin, though not from exactly the same point of view as the questions in the retention test.

The second chapter is divided into three sections:

A. Problems of economic organization
B. The technological choices open to any society
C. The underlying population basis of any economy

In the first section (A) it is stated that any society has to face the fundamental economic questions: "WHAT to produce, HOW and FOR

WHOM". The second section consists primarily of a discussion of the production possibility (p-p) frontier (B1) and the law of diminishing returns (B2). The third section deals with Malthus' theory of population (C). It was apparent from the subjects answers to the questions in the post-experimental interview that, according to their own appraisal of the chapter, a subdivision into the above mentioned four main topics could be made (A, B1, B2 and C). Whereas the last three sections have to do with fundamental concepts of economics, the first has a structuring function. The second section (B1) takes up half the chapter, and three questions in the retention test (1, 2 and 4) required comprehension of various aspects of this. The remaining two questions concerned the law of diminishing returns (3) and Malthus' theory of population (5).

The set of questions represents the experimenter's conception of the structure underlying the discourse. This conception is, however, not a result of a formal analysis, but rather the outcome of an attempt to understand the meaning of the text as deep a sense as possible.

All analyses were based on transcripts of recorded sessions. The greater portion of this work consisted in trying to find the categories of description and through them the distinctive features of comprehension of the various concepts. After the categories had been chosen and individual answers assigned to them, assessment instructions were decided upon. On the basis of these instructions and independent judgement was made by a judge who was ignorant of which group (E or C) the answer originated from. In cases where there was a difference between the two judgements, the final decisions was left to a third judge. This occured in 20.1 % of cases as regards the questions after Chapter 2. Lack of agreement was to a large extent a function of variation in whether what E said before a given answer was adjudged help (thus rendering the answer invalid) or not. In a new round of judgements (concerning question 5) where instructions were given that attention was to be paid only to the subjects' first answer, agreement as to placing within the three categories rose from 68.4 % to 89.5 % (see below).

R E S U L T S

A description of the outcome of learning

As the measures are intended to control the learning process in a qualitative sense, the dependent variable, in order to be suited to the experimental treatment, has to be a qualitative measure.

In our case we have compared the distribution of E group and C group subjects within the outcome spaces of the objectives.

The outcome space of an objective consists of the smallest number of distinct answer categories, (levels of outcome), with the content of the answers intact, that satisfies the total variation observed in the group investigated.

The performance of an individual with this method of analysis applied cannot be reduced to a single figure but has to be related to the content of the categories of the outcome spaces for the different objectives.

Although, according to the twofold purpose of this investigation mentioned above, it would have been desirable to give a complete presentation of all outcome spaces, this is not possible due to lack of space.

We shall however, give two examples from the questions after chapter two. They are both intended to explore the understanding of the law of diminishing returns i.e. if you vary one production factor e.g. labor and keep other factors constant the rate of increment of output will gradually decrease after a certain point. The reason for this is that every unit of the variable factor will operate on even smaller units of the constant factor(s).

Question 3

Can you show by means of a table what the law of diminishing returns means?

The law of diminishing returns states that the extra output gained will be successively ver "... when we successively

add equal extra units of a varying input to a fixed amount of some other input"
(Samuelson, 1970, p 22).

The book presents the following table as an illustration:

Man-years of labour	Total product (bushels)
0	0
1	2000
2	3000
3	3500
4	3800
5	3900

In the correct answer (level A) the total output is described as a negatively accelerated function of the variable production factor.

It should be noticed that only in 5 cases out of 38 was the original series of figures used (partially on the first occasion and in no cases on the second occasion). In four cases of these five the answer was on the A level on the second session too, though the series of figures was entirely new. In fact, in no single case did the 38 subjects answer with the same series of figures on the first and second occasions.

The answers on level B give a series of figures for the total output that increases at first and then drops off, such as 1.000, 1.500, 2.000, 1.500, 1.000.

Finally, level C contains answers that rise to a certain level and then stagnate, such as 1.000, 1.500, 2.000, 2.000, 2.000. The order (as regards depth) between B and C level is obviously indeterminate. Level A, however, is clearly more complex than either of them as it includes a second-order change (i.e. change of change):

A. DECREMENT of INCREMENT
B. INCREMENT and DECREMENT
C. INCREMENT and NO INCREMENT

Question 5

What connection has Malthus' theory of population with the law of diminishing returns?

A sufficiently deep comprehension of Malthus' theory involves the realization that it is a straightforward application of the law of diminishing returns. Earth is the constant production factor and the population is the variable one. The output will thus not increase at the same rate as the latter factor, but the increment decreases (level A). In the answers on level B the

popular conception of a "constant mass" of resources crops up again: The more who share it the smaller piece there will be for each.

Level C answers are focused only on the increment of population. The "constant mass" of resources is probably a tacit assumption.

A. INCREMENT (of population) > INCREMENT (of production)
B. INCREMENT (of population), NO INCREMENT (of production)
C. INCREMENT (of population)

A common feature is that difficulties in these kinds of problems seem to emerge when several factors interact simultaneously.

The method of circumventing these obstacles is to reduce the number of factors involved. Very often, unfortunately, this simplification is dysfunctional and results in incorrect knowledge.

(A more complete description of the outcome spaces is to be found in Marton & Dahlgren, 1975 and Dahlgren, 1975).

Experimental effects

The outcome of the experimental manipulation is dominated by:

(1) A significant difference between the two groups, in favour of the control group, on the questions following chapter one. ($p < .05$)

and

(2) A difference (that emanates from the three questions dealing with the production possibility frontier) in favour of the experimental group on the questions following chapter two. ($p < .07$)

If we translate this into experimental effects it seems as if the measures of control have had negative effects while in function but positive effects after their termination.

The statistical comparisons were based on a method (Fisher's permutation test) which was suited to the measurement of the dependent variable since it made possible the use of the original qualitative

characteristics in terms of categories in the outcome spaces to describe each subject.

During the delayed retention measurement the changes on intra-individual level could be described in the same categories that was used to describe the inter-individual differences during the first measurement. This indicates that the main long-term change in the outcome of non-verbatim learning is not disappearance but distorsion.

Although the value of the delayed measurement is somewhat doubtful as a description of forgetting (due to the uncontrolled effects of the interview procedure during the first retention measurement), it can be stated that the loss of this kind of knowledge follows totally different laws than does the retention of verbatim learning.

D I S C U S S I O N

The results of this experiment may appear to be somewhat counter-intuitive.

In the introductory part, an investigation by Marton (1975 b) was referred to. It is our opinion that the inferior performance in the experimental group might be analyzed in a similar way.

This means that the questions adjunctive to the text played the same role as the content-neutral questions put after each passage in Marton's experiment.

Instead of creating a learning algorithm with erosive effects on the content, our questions have probably induced a hyperintention syndrome (Marton, 1975 b) i.e. the subjects failed on the first chapter because they were too occupied with literally adjusting to the instructions. (Everyone who has tried to repeat a bulls eye at darts with spectators knows what we mean).

The experiences that were made during the reading of the first chapter, however, proved to be a fruitful investment when it came to the second chapter.

If the effects found by Marton (1974 b) can be described as changes from the "normal" processing in a negative direction, the effects in chapter two in our experiment might be regarded as a change in the positive direction.

Strong support for this assumption is to be found by an analysis similar to the model referred to above (Marton, 1975 b) where considerable differences were found between the two groups as regards whether mentioning a certain topic or describing the content of it was the dominating strategy of recall.

When analyzing the statements in the subjects´oral recall, which concern the concept of the production possibility frontier (the second major topic in the chapter) it was found that description was the common strategy in the experimental group while mentioning dominates in the control group. (See Table 3).

Table 3.
The production-possibility frontier. Number and type of expression given in recall.

	Control group	Experimental group	Total
Mentioning of principle	7	5	12
Meaning of principle	2	11	13
Total	9	16	25

$x^2 = 4.93$, $p < .05$, $df = 1$

As in the experiments by Marton (1974 a) and Rothkopf (1966) it is also reasonable to assume that the content-neutral instructions given to the experimental group contributed to the group differences.

The main conclusion arrived at in our investigation, as far as the experimental manipulation is concerned, is that positive effects on the outcome of learning in a qualitative sense are possible but that they

seem to demand their tribute. To use a metaphor: If you point out the firmament some of the spectators will look at your finger instead; but it is only after you have lowered your finger that some of the people start looking at what you were actually pointing at.

REFERENCES

Anderson, R.C. Control of student mediating processes during verbal learning and instruction. Review of Educational Research, 1970, 40, 349-369.

Dahlgren, L.O. On non-verbatim learning: Level of outcome as a function of level of processing. Manuscript, 1975.

Frase, L.T. Learning from prose material: Length of passage, knowledge of results and position of questions. Journal of Educational Psychology, 1967, 58, 266-272.

Frase, L.T. Some data concerning the mathemagenic hypothesis. American Educational Research Journal, 1968, 5, 181-189 (a).

Frase, L.T. Questions as aids to reading: Some research and theory. American Educational Research Journal, 1968, 5, 319-332 (b).

Marton, F. Some effects of content-neutral instructions on non-verbatim learning in a natural setting. Scandinavian Journal of Educational Research, 1974, 18, 199-208 (a).

Marton, F. Inlärning och studiefärdighet. (Learning and study skills). Rapporter från Pedagogiska institutionen, Göteborgs universitet. No 121, 1974 b.

Marton, F. On non-verbatim learning: II. The erosion effect of a task-induced learning algorithm. Reports from The Institute for Educational research, University of Göteborg, No 40, 1975 a.

Marton, F & Dahlgren, L.O. On non-verbatim learning: III. The outcome space of some basic concepts in economics. Reports from The Institute for Educational Research, University of Göteborg, No 41, 1975.

Marton, F. On non-verbatim learning: Level of processing and level of outcome. Paper presented at this symposium. 1975 (b).

Rothkopf, E.Z. Some theoretical and experimental approaches to problems written instruction. In Krumboltz, J.D: Learning and the educational process. Chicago: Rand - Mc Nally, 1965, pp 193-221.

Rothkopf, E.Z. Learning from written instructive materials: An exploration of the control of inspection behaviour by test-like events. American Educational Research Journal, 1966, 3, 241-249.

Rothkopf, E.Z. Two scientific approaches to the management of instruction. In Gagne', R.M. & Gephart, W.J. (Eds.). Learning Research and School Subjects; Itasca, Ill. in F.E. Peacock, 1968, pp 107-132.

Samuelson, P.A. Samhällsekonomi. Stockholm: Rabén & Sjögren, 1969.

Samuelson, P.A. Economics. New York: Mc Graw - Hill, 1970.

Svensson, L. Ways of learning and patterns of study. Paper presented at this symposium, 1975.

Säljö, R. On non-verbatim learning: Level of outcome as a function of level of processing. II. Some effects of anticipated test-requirements. Paper presented at this symposium, 1975.

ON NON- VERBATIM LEARNING: LEVEL OF OUTCOME AS A FUNCTION OF LEVEL OF PROCESSING. II.

Some Effects of Anticipated Test Requirements

Roger Säljö

The idea that the demands anticipated after learning are crucial for the type of processing that subjects engage in has long been recognized (cf. Marton, 1969, 1973 a, b; Anderson, 1970; McKenzie, 1973). This implies that the criteria used for evaluating learning can be conceived of not only as a dependent variable but also as an important independent variable which to a considerable extent determines the process and outcome of learning.

Several empirical studies have been carried out to investigate the effects of type of test and type of questions on learning. Terry (1933), Silvey (1951) and Dahlgren et al (1974) report that students subjectively experience that learning is affected by the type of test anticipated. The general result in studies of this kind has been that expecting an objective test leads to a more superficial level of processing i.e. focussing attention primarily on "signs", often expressed by subjects as "attending to details", while expecting an essay or oral test is subjectively reported as leading to the focussing of attention on "general principles and main points", thus suggesting deeper processing.

While studies involving only subjective reports have mostly yielded fairly clear-cut results, indicating that the type of test expected affects the kind of processing that subjects engage in, those involving an assessment of actual differences in performance have produced a more diffuse picture. Meyer (1934, 1935) compared the influence of two different "examination sets", requiring on the one hand recall (tests containing essay or completion questions) and on the other recognition (true-false or multiple-choice questions). He found that the type of test expected had a considerable impact on performance as measured by immediate as well as delayed testing. A "recall set", and particularly the anticipation of an essay test, led to higher performance except on immediate testing with recognition questions, and there are furthermore interesting parallels between subjective reports on level of processing and performance. Other studies, e.g. Vallance (1947), Hakstian (1971) have not corroborated these results.

Recently, several investigations have shown that questions interspersed with learning can have a considerable effect on the type of information to which subjects pay attention. Within research concerning mathemagenic activities a vast number of studies have been carried out to clarify the

effect of such questions on learning and the "... most intriguing single result from our work is that the character of questioning tends to shape the character of the knowledges which are acquired" (Rothkopf, 1968, p 127; cf. Rothkopf, 1972; Nelsson, 1973). Watts and Anderson (1971) show that repeated exposure to questions affects the type of processing that students engage in. When demands, as defined by questions given after studying short texts, became evident, subjects adapted their level of processing to the type of question expected. Marton (1975 a) carried out a study where an attempt was made to induce deep processing by inserting content-neutral questions (e.g. "Can you summarize the content of each ... subsection in one or two sentences?") after each section of a text. The results were somewhat unexpected in the sense that a control group, receiving no treatment, achieved a far better result on both types of criteria, questions and recall. It is furthermore interesting to note that the differences between groups persisted even after a two-month interval when a retention measurement was carried out. These quite dramatic differences in outcome can be attributed to the fact that instead of using the inserted questions in the way intended, subjects made it an end in itself to answer these questions. This resulted in a very superficial level of processing, since learning merely became equivalent to searching for the information subjects knew they would be asked for.

The author concludes:

> "The questions via which the requirements are defined, ..., are only signs of or means to, the real intended requirements, i.e. the acquisition of knowledge in the sense of competence. There are no limited sets of questions, however, which define competence. When subjects interpret the signs of intended requirements in such a way that they are identical to the intended requirements, they technify and narrow the task and make it trivial".
> (Marton, 1975 a).

Most studies on the problem of the effect of the demands of anticipated questions on learning have worked with quantitiative criteria of learning, in the sense that one has compared the number of correct answers achieved by different groups. However, as Marton (1975 b) points out the concept of level of processing and the assumption of a functional relationship between level of processing and level of outcome calls

for a description of level of outcome which is commensurable to the description of level of processing. In other words, the criterion must be sensitive to qualitative variations in outcome, since level of processing implies variation in a qualitative rather than in a quantitative dimension. To some extent this demand has been met in studies using questions from different levels in e.g. Bloom's (1956) taxonomy, although the classification in these cases primarily refers to characteristics of the questions per se rather than to characteristics in outcome of learning. Furthermore, and perhaps even more important, in the present study the description of qualitative differences in outcome refers to differences in the conception of a certain topic treated in the text, while in studies using taxonomical hierarchies knowledge at a higher level is usually different from knowledge at a lower level as far as content is concerned. This is reflected in the fact that different questions are used to measure knowledge at different levels. In our case, the description of qualitative differences in outcome refers to differences in how subjects answered the same question or recalled the same topic.

In the present study the aim was twofold: to apply the model of description of qualitative differences in learning and to induce alternative levels of processing and levels of outcome via the demand characteristics imposed on subjects through the nature of questions interspersed with learning.

According to the conception of learning elaborated by Marton (1975 b) the object of a person's attention during learning can be conceived of as varying in a qualitative dimension, being either on the surface of the discourse (the text per se or the sign) or on the intentional content of the discourse (what is signified by the sign). The independent variable in this tudy, intended to induce different levels of processing, was the nature of the questions put to subjects after reading. By giving questions which were answerable only if subjects paid very close attention to information in the surface structure of the text, and by making this demand highly predictable through repeated exposure to such questions, it was hoped that one could induce surface-level processing. Thus, we wanted to impose on one group of subjects (S1-group) a conception of learning which was essentially reproductive, i.e. learning was to be equivalent to being able to recall more or less

exactly what was said in the texts. Conversely, the other group of subjects were exposed to questions which aimed at inducing deep-level processing (DL-group). These questions were constructed with the specific aim of testing whether the subjects had comprehended some of the more fundamental assumptions and conclusions in the argumentation of the author.

M E T H O D

Forty female first-termers at the University of Göteborg served as paid subjects. They received no instructions in advance as to what they were expected to learn from the texts (three incomplete chapters, containing 2.113, 3.850 and 3.279 words respectively, from Coombs: The World Educational Crisis: A Systems Analysis, Swedish edition, 1971). Instead they were told to read the three chapters and be prepared to answer some questions on the content after reading each of them. Thus, the only clues available to subjects as to how to behave was the nature of the questions they received after the first two chapters (examples of the two different types of questions are given in appendix A). Besides being exposed to questions aimed at inducing deep-level processing, the DL-group were required to recall the chapter just read and to state the main points in it in a few sentences as a part of the experimental manipulation. The number of questions given to the SL-group after the first two texts was five and to the DL-group three, though there were some follow-up questions making the total number of questions given to both groups somewhat higher.

After reading the third chapter, both groups were required to recall and to summarize the main points in it in a few sentences as well as answer questions intended to measure surface-level and deep-level aspects of the content. (Examples of questions are given in Appendix). The results obtained on this text constitute our main dependent variable and the examples discussed below are, with one exception, taken from this text. A semi-structured interview was also conducted to gather introspective data on the effect of the experimental manipulation on level of processing.

The retention measurment was carried out after approximately 45 days and on this occasion all subjects were given all the questions given on the immediate measurement. 50/51

If, on the immediate measurement, subjects could not answer a particular question or gave an inadequate answer, they were provided with the correct one by the experimenter. The questioning after the third chapter as well as on the retention measurement was carried out by an experimenter ignorant of which experimental condition subjects had been exposed to. All sessions were conducted orally and recorded on tape and were later, for purposes of analysis, transcribed. All categorizations and classifications of subjects were carried out by two independent judges according to judgement instructions constructed by the present author.

RESULTS AND DISCUSSION

Description of Outcome of Learning

Both the recalls (on immediate measurement) and the questions were analyzed with the specific aim of detecting qualitative differences in outcome. The different conceptions of the various topics that appeared in recall or were inherent in answers to questions, were found to be classifiable as separate categories of comprehension or, to use an alternative expression, as different levlels of outcome. The different levels of outcome found in relation to a certain topic or question could then be aggregated to constitute an outcome space for that particular topic or question (cf. Marton, 1975 b).

Since the most important aspect of non-verbatim learning is that learning must be described in terms of its content, we shall have to give here a brief description of the author's own discussion of the points which relate to the outcome spaces to be presented below. Unfortunately this means that in the present context we shall have to be very brief concerning the results obtained, restricting our presentation to a few examples illustrating the general principles involved in the analysis of data and the effects of the experimental manipulation.

> In the third chapter the author discusses two alternative school admissions systems, the 'selective' and the 'open' system respectively. In the former only a certain proportion of a year's pupils is accepted, while in the latter case the individual pupil can decide whether to go on to, for example, high school or to leave the school system. In this connection the author also discusses problems that occur, both generally and in specific cases, when

the pass rate, i.e. the relative proportion of students entering the school system who subsequently leave it with a completed exam, becomes too low. However, in the excerpts used in this experiment the relationship between the type of admissions system and the pass rate is never made explicit. To check whether subjects had understood the very fundamental difference between the two systems in relation to the pass rate achieved, the following question was posed:

"Why does the 'selective' system as a rule have a higher pass rate?"

Excluding those subjects who could not answer this question, there are four different levels of outcome, i.e. ways of explaining why the selective system has a higher pass rate. The basic structure of these different levels plus an example of one of the answers classified at each level can be seen from the following.

(A) THE INSTRUMENT OF SELECTION IS CHOSEN TO PREDICT THE CHANCE OF SUCCESS.

"Because the criteria of selection are often constructed in such a way that people who get through the selection tests ..... the entrance exams, they get through what comes afterwards too."

(B) ONLY THE 'BEST' STUDENTS ARE ADMITTED.

"Because they've made certain of getting the élite."

(C) MORE STUDENTS PASS IN THIS KIND OF SYSTEM (no causal explanation given).

"Well, this was the system that most people managed to get through. With open system there were a lot of drop-outs."

(D) ONLY THOSE STUDENTS WHO ARE STRONGLY MOTIVATED APPLY/BEING IN A 'SELECTIVE' SYSTEM LEADS TO HIGHER MOTIVATION.

"Only people who are really interested apply."

Three of these levels, A, B and C, can be regarded as hierarchically related in the sense that the higher level(s) implicate the lower one(s) as regards the amount of information contained. The A level answers are very precise and indicate a fundamental understanding of the way a 'selective' system of the type discussed in the text actually works. The B level answers are less precise since they merely refer to the fact that the 'best' students are accepted without explaining in what sense they are best. However, without doubt the B level answers must be considered as wholly adequate in relation to the question and in passing it can be mentioned that the experimenter himself did not think of the A level type of explanation, but instead the answer prepared for subjects who could not answer the question or who gave in inadequate answer was of the B type. The C level answers are very low on information and may indicate a superficial level of processing. In fact, if we examine them carefully we find that they are merely

restatements of what is said in the question. It is, however, interesting to note that some of these answers represent a fairly exact recall of a part of the passage where the author discusses the differences in 'drop-out' rate.

The D level answers, focussing upon motivational aspects, are in another dimension and thus cannot be said to be hiererchically related to the other levels. Undoubtedly these answers are better than those at the C level, since they contain a possible, and very likely partially true, explanation of the differences in pass rate between the two systems, although this motivational aspect is not discussed in the text.

Table 1 shows the distribution of subjects on the different levels on the immediate as well as on the delayed measurement.

Table 1 Level of outcome on immediate and delayed measurement on question: "Why does the 'selective' system as a rule have a higher pass rate?"

Level of outcome: delayed measurement	Level of outcome: Immediate measurement A	B	C	D	O	Σ
A	1					1
B	2	9	2	3	2	18
C		1	1			2
D		3	1	2	2	8
O		2		1	5	5
Σ	3	15	4	6	9	37(1

1) The values of three subjects are missing. Owing to an oversight on the part of the experimenter this question was not given to two subjects while the third did not take part in the delayed measurement.

From the table we can note a remarkable stability in the answers. Actually there is a considerable variation in the words used by subjects to express their answers on the two occasions, but the basic structure of the answer given on the immediate measurement is in almost 50 per cent of the cases, including those categorized as O, repeated after a 45-day interval. We also note that the fact that subjects were given a B level explanation has had some effect, since 7 subjects who gave a lower level answer on the immediate measurement moved to the B level on the delayed measurement. On most of the questions which were qualitatively analyzed the general result, as concerns the differences between the answers on the two occasions, is that either the answers

contain the same basic structure on both occasions, or the answer given at the second measurement is more inexact and fragmentary thus being classified as belonging to a lower level. This general finding supports those reported by Marton (1975 b), where forgetting could be described in terms of a move from a deeper towards a less deep level.

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The description of qualitative differences in recall was a very complicated undertaking. There was an enormous variation in the surface structure of the recalls and there was also a considerable variation in length, from 0 to 850 words. In order to be able to deal with this somewhat chaotic heterogeneity, the text was divided into nine different topics which were used in the quantitative assessment of the extent to which subjects covered the text 'horizontally' in their recalls. On four of these topics a qualitative analysis was carried out and we shall restrict our discussion to one of these.

One of the main themes of the third chapter was the 'drop-out' problem, and its individual and social consequences were described fairly fully by the author. 27 subjects in one way or another touched upon this topic in their recalls and three different levels of outcome are discernible. We shall present the basic structure of these levels together with an example of each.

The first category of subjects were conclusion-oriented in their comments on this topic, in the sense that they included the most important aspect of the discussion concerning the 'drop-out' problem in their recalls, namely causes and/or consequences of the problem and/or the conclusions that can be drawn. This level (A) included 7 subjects and the following is an excerpt from one of these.

"...in countries like Africa, well, developing countries, where a lot of pupils drop out after the third or even the first grade, there's not much pressure on the higher levels ..... and in the developing countries they look at things so much from the point of view of sex roles. It's usually girls who drop-out and in rural districts it's also been pointed out that there are more drop-outs and it may be that cultural and economic factors ..... (are decisive) and it may be ..... well ..... just dreary teaching ....."

The next level consists of subjects who more or less fully described what the author said about the 'drop-out' problem without including causes, consequences or conclusions. 9 subjects were categorized as belonging to this level (B) on this particular topic.

"It was about drop-outs in the USA and in various developing countries ..... in the USA, for example, more people drop-out at se-

condary education and in the developing countries the number who drop-out at the primary stage is very large."

The last category of subjects treated this topic only very superficially and they merely mentioned that the author had discussed this topic. 11 subjects were classified on this level (C).

"It was about drop-outs and failures ....."

The description of qualitative differences in recall exemplified here follows the same implicatory model as the description of the answers to the questions. The conclusion-oriented utterances contain at least a part of the intentional content of the author's treatment of a certain topic, i.e. the causes and/or consequences and/or conclusions the author wants to extract and point out in his discussion. Level A thus implies level B, which only contains a description of a state of fact, and level C, finally, contains no information at all about what was said concerning a certain topic.

Experimental Effects

The subjective reports indicate that the demand characteristics imposed on subjects through the interspersed questions had a considerable impact on level of processing. In the SL-group this impact was quite uniform, in the sense that subjects reported that they paid very close attention to the surface structure of the text, e.g. to lists of points and figures. For some subjects this was evidently quite in line with their usual conception (or definition) of learning, while others had to modify their regular learning strategy in order to fulfil the requirements as they experienced them. This is illustrated by the following two quotations from subjects in the SL-group:

"E: What did you think of the questions? Did you think they were easy or difficult?

S: I thought they were good, anyway. At least on the first two sections. I thought they were more or less what you might expect to be asked."

"E: What did you think of the questions? Were they easy or difficult?

S: Well, I got a shock. There were only two questions I could answer on the first bit and there was ..... All the rest was sort of detailed questions about figures and I wasn't in the least prepared for that sort of thing."

E: The second and third time, how did you manage on the detail questions then?

S: Well, then of course I'd .... then I was more prepared for them so I tried to learn the stuff I expected to come up."

In the DL-group the influence of the experimental manipulation was less uniform and basically two modes of coping with the requirements were developed. One category of subjects used the predictability of the demands of the forthcoming tasks to develop an algorithm for learning, focussing primarily upon being able to recall the text and summarize the main idea in it in one or two sentences. Judging from the subjective data, the demands imposed on this category of subjects through the 'deep' questions were too vague, in the sense that subjects did not experience that what was required of them was deep processing, the consequence being that they technified learning, making it an end in itself to fulfil the most explicit demand, viz. that of recalling and summarizing the text in one or two sentences.

"E: When you read this third piece, were you influenced by the questions you'd been asked on the previous pieces? Did you think about what you would .....?

S: Well yes, I did a bit. I thought about learning .... that I was going to make a summary, but that was about all really."

"E: What did you think of the questions? Were they of the type you had expected?

S: Well, I don't know. I'd thought that they'd possibly be a bit more clear-cut: What was that? and so on.

E: Hmm.

S: They were sort of .... not general .... but a bit more on the content in general."

As we shall illustrate, later the recalls resulting from this interpretation of the demands are very low on information, containing almost exclusively superficial mention of the various problems dealt with in the text.

The other mode of coping with the requirements was more in line with the intentions behind the experimental manipulation, i.e. using the predictability of the coming demands as a reason for adopting a certain type of processing.

"E: When you read this third text, were you influenced by the questions you had had previously and, as it were, of what you had experienced?

S: Yes, I was. I must admit that I was.

E: In what way was that?

S: It helped me.

E: Hmm. For example, when you read the first piece and then you went on to read the second. Did you think while you were reading the second piece that you could more or less predict what questions would come up?

S: Yes, more or less.

E: I see. So you made use of the previous questions to .....

S: Yes, I did.

E: I see.

S: But I got some help too as to <u>how</u> to read the piece. The questions you asked me put me on to a good way of reading the piece somehow.

E: How do you mean?

S: Well, it's just that .... When I read through a passage. I think it's difficult to know .... what am I really trying to get out of this, what am I supposed to read, what am I supposed to learn?

E: Hmm.

S: So the first questions I got, in the first piece, taught me somehow to think about what was actually most important in what I was reading."

It is interesting to note, however, that some subjects in this category had a negative definition of the demands, in the sense that they realized what type of information they would not be tested on, but they were somewhat vaguer as regards what type of information they had actually focussed on during learning.

Actual differences in performance, corresponding to the subjectively reported data concerning level of processing, are readily found in recalls as well as in answers to questions. Comparing the two experimental conditions, we find a marked difference in how close to the surface structure of the original text subjects recall the text and answer questions. Consider for instance the following excerpt from the third text and the excerpts from recalls of two subjects in each group.

The text:

"Another common source of difficulty is the imbalance between the output of sub-professionals and full professionals in associated fields. The proper ratio may differ by countries and by fields, yet it is still a universal problem. If the trained professional is to be fully productive, he must be backed by sufficient para-

professionals and technicians who can perform appropriate supporting tasks. Guy Hunter suggests that the optimum ratio of technicians to university graduate specialists is between 3: 1 and 5: 1, depending on the country and the subject. Against this norm, he and other investigators have found that in many developing countries this ratio is often 2: 1 at best and sometimes only 1: 2. In these circumstances full professionals end up doing the tasks which sub-professionals should be doing.

A good example of this is provided by Chile, in the field of health, where an investigatior reports three doctors for each nurse, in contrast to Sweden's ratio of five nurses for every two doctors and the United States ratio of seven nurses for two doctors. To make matters worse, the number of nurses graduating in Chile has recently been about half the number of doctors." (Coombs, 1968, pp. 77-78)

Excerpts from SL-group:

"... then there was the ratio of professionals to sub-professionals, someone or other had said that the ratio should be between 3-1 and 5-1, that is a trained professional should have 3-5 assistents but usually it was about 2-1 or at worst 1-2 and there they compared Chile, Sweden and the USA. In Chile there were 3 doctors to one nurse, in Sweden 5 nurses to 2 doctors, and in the USA 7 nurses to 2 doctors, and anyway it was worst in Chile, because a lot of nurses emigrated to America when they had done their training, because there was still a shortage of nurses there."

"... and then there were examples from .... there was some American expert who had stated that the ratio of technicians to professionals should be roughly between 3-1 and 5-1, which in the developing countries was at best 2-1 and at worst 1-2, and there were some examples that in Chile there were 3 doctors to one nurse, in Sweden 5 nurses to 2 doctors and in the USA it was 7 to 2 and even so somehow that nurses in Chile often emigrate to the USA because the pay is better there."

As can be noted there is a striking similarity between the original version and these recalls. The subjects in the DL-group on the other hand treated this topic from a more general point of view in most cases, as can be seen from the following excerpts:

"And then there are problems in various areas, that is the pace at which professionals are trained in a certain area must bear a relation to, have a certain relationship to the training of less qualified staff in the same area. That is, a professional must have a largish number of technicians under him, otherwise he'll have to do the work himself, that is the whole thing is wrong."

"... and then they say that on the whole it's like that in various countries that these, what shall I say, the ratio of qualified to less qualified people is sort of the wrong ratio, that is there aren't enough assistants to researchers and so on, sort of, so researchers have to do the sort of jobs they, well, so they haven't got time for what they're really supposed to be doing, 'cos they've got to do a whole lot of other things and so on."

Significant differences between groups on immediate as well as delayed measurement can also be found on the questions, but since, as has been pointed out earlier, the presentation of this type of material is necessarily somewhat lengthy, we shall not discuss this in detail in the present paper (for a complete account see Säljö, 1975 a). Instead we shall limit our discussion to some interesting aspects of the learning process illustrated in the present study. As we have shown, the between-group differences point to a clear modifiability and context dependence of a person's conception of learning: in other words, learning seems to be defined differently depending on, for instance, anticipated task demands. The same observation can be made if we look at the results obtained within the DL-group. As we pointed out earlier, the subjective reports indicate that subjects in this group interpreted the demand characteristics differently. Some subjects focussed attention primarily on the recall question, thus making it an end in itself in order to be able to deal with this particular task. This resulted in recalls which were virtually devoid of information, but in many cases fairly comprehensive, in the sense that subjects mentioned many of the topics which the author dealt with. Consider the following quotations which are the complete recalls of two subjects in the DL-group:

> "Well, it was about drop-outs and failures, about various admissions systems, and the need of certain types of education, and future prospects."

> "It was about the end-product of education roughly. How it can affect society afterwards. They mentioned drop-outs and failures in various countries .... in the developing countries compared with the industrialized countries .... more or less .... how the future looks."

These cases illustrate how learning can be technified when task demands become predictable. Learning under these circumstances runs the risk of being reduced to a search for the type of knowledge expected on the test (cf. Marton, 1975 a). Letting the distinctive features of the type of evaluation anticipated determine learning will undoubtedly to some extent result in learning which may be suitable for that particular purpose, but which otherwise in most cases must be considered as very poor. With the type of evaluation used in most educational contexts there is a great danger that we maximize the importance of these particular aspect of learning. As Miller and Parlett (1974) have shown, the extent to which a student is engaged in trying to predict what will be expected of him in

tests seems to a considerable degree to be related to the results he will in fact obtain.

Another interesting observation can be made in this connection if we look at subjects' normal conception of learning as demonstrated by what type of material they paid attention to in the first passage, i.e. before subjects were exposed to the experimental manipulation. This can be illustrated by looking at one of the questions given to the SL-group after reading the first chapter.

> Here the author discusses various aspects of unbalanced growth in different fields of society and in this connection he makes five general propositions:
>
> > "If population grows faster than food production, each year there will be less available on the average for each person to eat. If the educational system grows faster than the Gross National Product, and it has been doing so for some time, it will sooner or later have to slow its growth until the economy catches up. If the educational system turns out graduates faster than the economy can give them jobs, unemployment among the educated will increase. If the child population expands faster than the educational system can absorb them and give them a decent education, there will be either a lower participation rate than desired or overcrowded schools of poor quality.
> >
> > If <u>all</u> these critical rates of growth-economic, agricultural, demographic, and educational-get seriously out of balance, the nation's whole development process will be in in trouble, not merely economically, but socially and politically." (Coombs, 1968, pp. 25-26)

A question relating to these propositions was given after the subjects of the SL-group had read the first text:

> "Can you repeat the author's five statements about the relationship between growth and development?"

The prime intention behind this question was to induce surface processing, in the sense of making subjects focus attention on this type of listing of information irrespective of whether it could be considered as important or not, but it became obvious that this kind of material was very much in line with what subjects had expected to be tested on. This is evident from the subjective data from both groups (the subjects in the DL-group saying that this was the type of question they had expected instead of the ones they actually received) as well as from the fact that the subjects in the SL-group remembered on an average

2.75 of these propositions immediately after having read the text. Thus, it seems that for many subjects learning from a text like the present one means being able to restate among other things lists of this kind. As regards long-term retention, the above seems to be a very unfortunate conception of learning, since what is retained as measured by the same question after 45 days is only .2 which is indeed a very low figure compared to the very high level of retention on questions relating to more fundamental aspects (cf. Säljö, 1975 a; Dahlgren, 1975).

The same detrimental effects on long-term retention can be shown when the superficial conception of learning (or level of processing) was experimentally induced. It has been shown elsewhere (Säljö, 1975 b) that this type of processing covaries with relatively high performance on immediate testing of knowledge from the surface structure of a text. As regards long-term retention however, the picture seems to be completely different, in that subjects who were being manipulated towards deep-level processing show a higher level of retention even on the type of material on which, for immediate testing, superficial processing seems to be efficient. With this type of knowledge there thus, seems to be a possibility that what is learned may in fact differ even when the outcome is identical.

The crucial aspect of learning described in this study is the functional relationship between level of processing and level of outcome. One of the main determinants of level of processing in educational contexts is the student's subjective conception of the demands of tests used to evaluate learning. Using the evaluation of knowledge consciously, as a means to induce the kind of processing we should prefer students to engage in, thus becomes imperative. A very important aspect of this is to make clear to students that their present conception of learning, which will exert a decisive influence on what they personally get out of their schooling, may in fact emanate from taking too many tests requiring only slightly more than verbatim recall.

REFERENCES

Anderson, R. C. Control of student mediating processes during verbal learning and instruction. Review of Educational Research, 1970, 40, 349-369.

Bloom, B. Taxonomy of educational objectives, Handbook I: Cognitive domain. New York: McKay, 1956.

Coombs, P. H. The World Educational Crisis: A Systems Analysis. New York: Oxford University Press, 1968.

Coombs, P. H. Utbildningens världskris. Stockholm: Bonniers, 1971.

Dahlgren, G., Ekholm, M., Fransson, A. & Rovio-Johansson, A. Grupp-examination och självständigt arbete. (Examination in groups and independent work.) Rapporter från Pedagogiska Institutionen, Göteborgs Universitet, nr 115, 1974.

Dahlgren, L. O. On non-verbatim learning: Level of outcome as a function of level of processing. I. Some effects of explicit control. Paper presented at this symposium, 1975.

Hakstian, A. R. The effects of type of examination anticipated on test preparation and performance. Journal of Educational Research, 1971, 64, 319-324.

Marton, F. Evaluering av evalueringar. (Evaluation of evaluations.) Rapporter från Pedagogiska Institutionen, Göteborgs Universitet, nr 42, 1969.

Marton, F. Evaluering på system- och individnivå. (Evaluation of systems and individuals.) Chapter 13 in Handal, G., Holmström, L-G. & Thomsen, O. (Eds.) Universitetsundervisning, Problem - Empiri - Teori. (University teaching.) Malmö: Studentlitteratur, 1973, (a).

Marton, F. Evalueringsteori och metodik. (Theory and Methodology of Evaluation.) Chapter 14 in Handal, G., Holmström, L-G. & Thomsen, O. 1973, (b).

Marton, F. On non-verbatim learning: II. The erosion effect of a taskinduced learning algorithm. Reports from the Institute of Education, University of Göteborg, No. 40, 1975, (a).

Marton, F. Level of processing and level of outcome. Paper presented at this symposium, 1975, (b).

McKenzie, G. Quizzes: Tools or tyrants. Instructional Science, 1973, 2, 281-294.

Meyer, G. An experimental study of the old and new types of examination: I. The effect of the examination set on memory. Journal of Educational Psychology, 1934, 25, 641-661.

Meyer, G. An experimental study of the old and new types of examination: II. Methods of study. Journal of Educational Psychology, 1935, 26, 30-40.

Miller, C. & Parlett, M. Up to the mark. A study of the examination game. London: Society for Research into Higher Education, 1974.

Nelsson, O. Undervisning och matemageniska aktiviteter. En litteraturöversikt. (Teaching and mathemagenic activities. A literature survey.) Report from the institute of Education, University of Lund, No. 37, 1973.

Rothkopf, E. Z. Two scientific approaches to the management of instruction. In R. Gagné & W. Gephart (Eds) Learning research and school subjects. Illinois: Peacock, 1968, pp. 107-132.

Rothkopf, E.Z. Structural text features and the control of processes in learning from written materials. Chapter 12 in J. B. Carrol & R. O. Freedle (Eds) Language comprehension and the acquisition of knowledge. Washington, D. C.: Winston, 1972, pp. 315-336.

Silvey, H. M. Student rection to the objective and essay test. School and Society, 1951, 73, 377-378.

Säljö, R. On non-verbatim learning: Level of outcome as a function of anticipated test requirements. Manuscript, 1975, (a).

Säljö, R. Some observations on the functional relationship between level of processing and level of outcome in non-verbatim learning. Forthcoming, 1975, (b).

Vallance, T.B. A comparison of essay and objective examinations as learning experiences. Journal of Educational Research, 1947, 41, 279-288.

Watts, G. H. & Anderson, R. C. Effects of three types of inserted questions on learning from prose. Journal of Educational Psychology, 1971, 62, 387-394.

Terry, P. W. How students review for objective and essay tests. The Elementary School Journal, 1933, 33, 592-603.

Appendix (1)

Examples of questions aimed at inducing surface-level processing (given to SL-group after chapters 1 and 2).

1. According to the author there are three reasons for the general increase in demand for education. Can you recall these?

2. According to the author the shortage of teachers depends on three factors. Which three?

3. What are the approximate male/female proportion in the teaching profession at the primary and secondary school level in Great Britain? At the primary school level in Austria?

Appendix (2)

Examples of questions aimed at inducing deep-level processing (given to DL-group after chapters 1 and 2).

1. PUPIL INPUT IN DIFFERENT PARTS OF THE WORLD
(1950 = 100)

Area	Year	Primary school 1960	Primary school 1963	Secondary school 1960	Secondary school 1963	Higher Education 1960	Higher Education 1963
Africa		223	273	271	364	267	345
Europe		114	119	160	186	161	211
Latin America		175	203	227	325	203	262
North America		142	153	161	192	157	197
Southern Asia		175	204	213	267	240	273
Whole world		140	157	172	210	179	230

Look at this table and answer the following question:

a) What can one learn from this table and what do the figures signify?

b) Why are the figures for Africa, Latin America and South Asia higher than those of Europe and North America?

c) Which level of education has increased most rapidly?

d) What is meant by 1950 = 100?

2. What is meant by "... educational demand, feeding on itself, creates its own dynamic"?

3. Could you explain the meaning of the following quotation "... too many poor teachers will drive good ones out of the market"?

Appendix (3)

Examples of questions given after chapter three to all subjects.

1 a. What is meant by the term 'output of education'?

b. What is the simplest way of measuring the output?

2. What is the approximate percentage studying agriculture at an academic level in the developing countries?

3. The drop-out problem during primary education is a difficult problem for most developing countries. Which categories of children are most likely to drop-out at this early stage? Why just these children?

4. What problem could the developing countries run into if they suddenly were able to cope with the drop-out problem at primary education?

WAYS OF LEARNING AND PATTERNS OF STUDY

Lennart Svensson

I N T R O D U C T I O N

This paper is the last of four closely interrelated papers presented at this session. All four papers emanate from work on the same project comprising of several interrelated investigations.

The three papers presented previously (Marton, 1975; Dahlgren, 1975 and Säljö, 1975) have very similar titles. They begin with the term 'non-verbatim learning' which refers to an area of research. The subject matter of these papers is also confirmed to this area. All three titles also include the terms 'level of outcome' and 'level of processing'. The aim of the papers is to elaborate and exemplify the meaning of these two terms and to analyse the functional relations between the phenomena referred to by them. Two of the papers also concern differences in the level of outcome as a function of experimentally manipulated differences in the level of processing (Dahlgren, 1975 and Säljö, 1975).

The concepts of level of outcome and level of processing are extremely central in this paper too. However, some other terms will be frequently used referring to two broad categories of levels of outcome and to two categories of level of processing. This paper also differs from the others in that it does not only deal with the area of non-verbatim learning.

The terms holistic approach and atomistic approach will be used when referring to two levels of processing corresponding to those described by Marton (1975). A holistic approach is a direction towards a message (of a learning material) as a whole. An atomistic approach is a direction towards parts of a message without attention to the "whole-qualitities". (cf. Wertheimer, 1945).

Wertheimer (1945) and Katona (1940) have very clearly demonstrated the dependence of learning upon the meaningfulness of the learning situation. This corresponds to differences in levels of processing described in terms of differences in conditions of learning. In the present context the concepts of holistic and atomistic approach are used as a means of stressing the dependence of learning upon the learner himself.

From the point of view of inter-individual differences, the two levels of processing will be concentrated on here in relation to other aspects of study activities and in relation to the outcome of learning. The term 'way of learning' refers to the learning activities of an individual on a single learning occasion and the related outcome of learning. The term 'pattern of study' refers to aspects dependent on the combination of several learning occasions within an individual.

Ways of learning and patterns of study do not exist independently of each other. In some cases pattern of study is an irrelevant aspect. This is so when the phenomenon investigated constitutes one learning occasion. However, when pattern of study is one aspect way of learning is another. In the research reported below ways of learning and patterns of study have been treated as one area of inquiry referred to by the term 'study skill'. The work had two aims: 1) to make delimitations and distinctions within the concept of study skill and 2) to find appropriate methods for doing so. Below we shall treat four topics:

1. The concept of study skill.
2. The methodological rationale followed in our research.
3. Holistic - atomistic approach as the dominant aspect of the relation between previous knowledge and subsequent learning.
4. Holistic - atomistic approach as indirectly related to academic success.

The two last points could be given in the form of assertions by changing 'as' to 'is'. These assertions are the most interesting conclusions from the results of each of two parts of the investigation presented here. The ideas and results presented below are more fully elaborated and described elsewhere (Svensson, 1975).

S T U D Y S K I L L S

'Study skill' refers to a relationship between a criteria of learning and study activities relative to a situation. The term refers to such a relationship irrespective of the content of the criterion, the activities and the situation. This definition of the term equals a delimitation of a problem area and the problems are what the contents of such relationships are and how they are dependent on the contents of the components (activity, situation and criterion).

The definition of study skill as a relational concept enables us to find the instances of the concept i.e. the denotative meaning of the term. The delimitations and distinctions aimed at must then be based on descriptions of, and comparisons between, such instances.

Essential to our conceptualisation of study skill is that the instances are the functional relations between the total activity of individuals in and towards a situation and a criterion of learning. We find this relation to be complex with many aspects being relevant. The cognitive activities are concentrated on because they are the most general and necessary component. The functional relations referred to are relations within single individuals.

Neither the term nor the definition are invented out of context but are chosen because they are related to phenomena central to all education. The instances are the relations between all observations of the outcome of learning (tests or examinations) and preceeding activities relative to a situation.

In our work we have posed questions concerning study skills in relation to higher education. This restricts the choice of instances to individuals of a certain age and educational background and also to material of a certain kind. Our actual choice of instances is even more restricted. However, we think that the results presented here and other corresponding results in our work have a fairly high degree of applicability.

Most of our work has concerned experiments in learning. There are two main reasons for this. One is that it is difficult to clarify the

relationship between the criterion and the cognitive aspects of the study activity for instances taken from normal studies. The other reason is that we are not prepared to accept the criteria represented by the examinations as to what ought to be the main consequences of learning. The investigations into ways of learning presented below have been made considering these phenomena as instances or components of instances of study skill. Study patterns have been considered as components of instances of study skill.

THE METHODOLOGICAL RATIONALE

The theoretical aim of the work was said to be delimitations and distinctions within the concept of study skill. The concentrating on concepts rather than relations between concepts is a part of our epistemological view. We have found the possibilities of making generalisations in terms of general laws to be very limited within the human sciences. This depends on the fact that all studied functional relations are, to such a great extent, of a conditional character i.e. depending on varying conditions outside the studied relation. That is to say that most such relationships studied seems to be highly dependent on context. This raises the question about identity in such relationships between cases studied when there is a difference in context. Thus the study of functional relations also become a question of the meaning of such relations in the contexts or the concept of the relation.

Instead of aiming at general laws we have to delimit relational concepts which shall be clearly anchored in contexts in order to obtain instruments for collection of data and analyses in new contexts and in order to obtain more applicable concepts from comparisons of meaning in different contexts. It must be stressed that the individual studied as an agent in a situation constitutes and defines the meaning of the context. To obtain high generalizability in the form of a theory then equals developing relational concepts out of many instances representing great differences in context. To generalize from theory to separate instances (or groups of instances) (state hypotheses, make predictions) presupposes not only knowledge of the presence of a causal factor to state the effect, but knowledge of the context to decide the applicability of different concepts.

The principle for developing concepts is abstraction, it is the sorting of observations according to certain similarities and at the same time considering the differences in other respects as irrelevant. Through this abstraction we get a higher degree of parsimony on the theory level than on the observation level. At the same time the content of the process of abstraction, i.e. the similarities and differences in meaning between instances, constitutes the relation between theory and observations. We thus find that the fundamental principle for building theories is the development of concepts and that the principle for this is abstraction through interpretation. Elaborating the content of the abstractions is then the same as clarifying the relation between theory and observations.

The view and formulation of the research problem should decide the design and methods used. Our view of the problem is not compatible with the principles for analysis[1] of data used within the correlational and experimental traditions of research. The most apparent incompatibility is that between the aim of investigating functional relations and the analysis of data by means of statistical methods resulting in group characteristics. The use of these methods implies strong assumptions with regard to similarities between different individuals as functional units. These assumptions are, in most cases, false.

The statistical measures normally used in educational research do not represent functional entities but methodological artefacts hiding the functional relations. This is also true with regard to the variables on which these measures are based. The individuals are the functional units and that which exists is in the form of combinations of characteristics within individuals. We describe such combinations (instances) and compare and group them as a basis for generalizations in the form of concepts.

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[1] The term 'analysis' is used in accordance with the definiton given by Kerlinger (1973): "Analysis means the categorizing, ordering, manipulating and summarizing of data to obtain answers to research questions". (p. 134)

R E S U L T S

The results presented by Marton (1975) have been obtained through analysis of parts of one of the two sets of materials that will be referred to here. Ference Marton and the present author have made parallel analyses of these parts. The high correspondence found between the parallel analyses is claimed as a proof of a clear inter-subjective relationship between the concepts and data concerned.

The first material considered below was collected from thirty subjects who were freshmen at university studying Education. We followed their studies during one term through three interviews and by collecting their examination results. A learning experiment was coordinated with these interviews and constituted the greater part of the material. A second set of material was collected for twenty-nine students in the Social Sciences. They were followed in their normal studies during a period of one year and two experiments not presented here were arranged (Marton, 1974; Marton, 1975). Twelve of the subjects were freshmen and the others were "older" students (not freshmen). The data referred to here was comprised of three interviews.

Both the experiment and the interviews were carried out as individually administered sessions in which practically all communication between subject and experimenter (interviewer) was oral. Communication was recorded and the analyses were made on the transcripts of these recordings.

Ways of learning (an experiment)

For the first group mentioned above there were three sessions of data collection besides the normal examinations. These three sessions made up both the experiment and the interviews concerning the normal studies. The sessions were held with a five week interval at the beginning, the middle and the end of the term. The main sections of the three sessions are given below in their sequential order. The three sessions are also numbered according to their order in time.

Session I	Session II	Session III
Introduction	Introduction	Introduction
Reading of text I	Retelling of text I	Retelling of text II
Retelling of text I	Introspective reports	Introspective reports
Introspective reports	Reading of text II	Questions on text II
Questions on text I	Retelling of text II	Questions about ordinary studies
Questions on vocabulary	Introspective reports	
	Questions on text II	
Questions about ordinary studies	Questions on vocabulary	
	Questions about ordinary studies	

The introspective reports concerned cognitive activity during reading (after immediate retelling of each text) and during retelling. As can be seen, the design of the learning experiment was the following.

Session I	Session II	Session III
Reading of text I	Delayed retention of text I	Delayed retention of text II
Immediate retention of text I	Reading of text II	
	Immediate retention of text II	

Questions on text I were left out at the delayed retention measurement. This is because it would have been a learning occasion and could have influenced the reading of text II.

The design was based on the relationship between the reading of two texts. We will here concentrate on this relationship and the question concerning the nature of the relationship between previous knowledge and subsequent learning (topic three mentioned above p. 2). First, however, we shall say something about the texts and the conditions for reading them and about the main aspects considered in the evaluation of the experiment.

The content of the first text has been described previously (Marton, 1975). The second text, was a revised and expanded version

of the first text written by the same author. It was roughly three times as long but contained essentially the same message as the first text. The content of the message was some conclusions based on given premises (or opinions justified by arguments). The premises (arguments) consisted of empirical data of a statistical nature.

There was a difference in the conditions under which the two texts were read. The subjects were instructed to read the first text once with no time limit. They were allowed to reread parts of the text while reading through it, but were not allowed to reread anything after they had reached the end. They were, however, instructed to read the second text any way they saw fit with no time limit. The subjects were told before reading the texts that they would have to retell the content and answer questions on the content afterwards.

The main aspects concentrated on here are level of outcome and level of processing. Marton (1975), presents four levels of outcome and two levels of processing for the first text. There was a futher level of outcome for the second text and a greater variation in content within the levels. Here we will confine ourselves primarily to two main levels of outcome; these also cover the four levels for text I and the five levels for text II. The two levels of outcome are referred to as "Conclusion" and "No conclusion". The first level contains formulations with the intentional structure of the texts preserved, i.e. conclusions in relation to the premises. (These formulations are placed on levels A and B in Marton's (1975) presentation of the levels of outcome). The second level contains formulations without this intentional structure. (These formulations are to be found on levels C and D in Marton's (1975) presentation). The formulations considered are the retellings and answers to a question about what the author wanted to say. When the term 'levels of outcome' is used below it refers to these two levels. Levels within these two categories are specified as subcategories. The two levels of processing are referred to as a holistic approach and an atomistic approach (cf. above p. 1).

Ference Marton and the present author have developed separate systems of categories. Intensive discussions about the aspects took place but the development of categories and the interpretations of the data for the different individuals were made independently. One of the systems

of categories was based only on the first text. The inter-judge agreement between the two categorizations for the first text (after "calibrating" the systems of categories) was very high on all levels (categories, subcategories and indications). There was inter-judge agreement for the two levels of outcome in twenty-nine cases out of thirty for both immediate and delayed retention taken separately. A comparison between a total categorization of level of processing in three categories (positive, indifferent and negative) showed agreement in twenty-five (of thirty) cases.

The differences in combinations of levels of outcome between the texts and between immediate and delayed retention can be described to a great extent by dividing the subjects into three groups.

Group one: Ten subjects were placed in "No conclusion" on all occasions.

Group two: Seven subjects were placed in "Conclusion" on all occasions.

Group three: Seven subjects were placed in "Conclusion" on three of the four occasions but in "No conclusion" for delayed retention of text I.

The twenty-four subjects grouped above all had the same level of outcome for both texts for the immediate retention. It is this correspondence we shall concentrate on here. Among the six exceptions from the three groups, five were exceptions from this correspondence. The sixth was placed in "No conclusion" only for delayed retention of text II.

One subject was placed in "Conclusion" only for immediate retention of text I, and three only for immediate retention of text II while one was placed in "Conclusion" for text II but not for text I. This last person represents the only radical difference between the two texts. She was placed on the highest level of outcome (subcategory) for text II on both occasions. There is strong evidence from the interviews that her activity in the first session was not representative for her usual study activity. The four other exceptions from the correspondence had minor differences. The one in "Conclusion" only in the first session was among those with the worst answers in this category. The three in "Conclusion", only for immediate retention of text II belonged to a level of outcome (subcategory) represented only for text II. This level of outcome was in fact the lowest level in the "Conclusion" category.

What then was the functional relation behind this high correspondence between the levels of outcome for the two texts? Why did those subjects who were worse not raise their level of outcome and reach a conclusion. Was it because they were fixated to the memory of the first text? And did the best subjects reach a conclusion because they remembered it from the first text? As is evident from what has been said above (p. 8) the knowledge of the first text represented previous knowledge in relation to the second text in a direct way, since the latter was an expanded version of the first.

There is evidence that the memory of the content of text I was not a condition for reaching a conclusion with regard to the second text. Group three above had no more knowledge of text I than those without a conclusion with regard to text II. They had not reached a conclusion when delayed retention of text I was observed and they did not have a more extensive knowledge of the parts and details of text I when immediate retention was required. Yet they reached a conclusion on immediate retention for both text I and text II.

Recognition of a specific content of a level of outcome (subcategory) could be an explanation of the high correspondence between the immediate retention of the two texts. When we analysed the content of five levels of outcome and two parallel categories on two of the levels (due to concentrating on two different aspects of the texts) only two of all thirty subjects had the same content on both occasions. Nor did the information from the subjects reveal recognition of this highest level in their answers. Most of them seemed to believe that the texts were much more different than they were.

Thus the high correspondence between the levels of outcome was not due to previous knowledge in a more specific sense. It must then be dependent on a correspondence in learning of a more general character - a correspondence in the approach to the content (leading to recognition of the intentional structure (conclusion structure) in a more general sense). This is strongly supported by the very high correspondence between the levels of outcome and the levels of processing in reading. There were only two exceptions with regard to text I and three with regard to text II (the three placed in "Conclusion" only for text II) from such a correspondence.

A holistic approach in retelling had higher correspondence with stability, extent and correctness of the answers than with level of outcome. Most of the subjects in group three had worse answers in these respects and an atomistic approach in retelling during immediate retention and then no conclusion for delayed retention. This also supports the interpretation that it was a correspondence between levels of processing during the reading of the two texts that was functionally behind the correspondence between the two levels of outcome for the two texts.

We can thus conclude that the main difference between the subjects in learning the texts was a difference in approach to the message communicated and not differences in any more specific knowledge.

Ways of learning and patterns of study (normal studies)

For differences in approach of the kind observed in the learning experiment to be of importance in normal studies they must have their equivalents in these normal studies (cf Schwartz, 1971). The data concerning the studies in Education and in Social sciences have been categroized as to approach. The subjects were not directly asked about their approach but only about how they read their set books in general terms.

For the group studying Education there were differences in the type of indications of approach between data from the learning experiment and data concerning the normal studies. (This is also mentioned by Marton, 1975). This was probably dependent on the difference in the relation to the learning material between the two kinds of information obtained. The information was more directly tied to the learning material in the experiment. Describing their normal studies in general terms very few subjects pointed out that they were directed towards details and surface aspects and memorized without understanding. This means that the subjects could be grouped mainly as to indications of a holistic approach and the absence of such indications. The atomistic approach thus means the absence of indications of a holistic approach in most cases.

In table 1 are given the relations between approach in the learning experiment and in the normal studies in Education and between these

categorizations and a criterion of academic achievement. The subjects who had passed the examinations in five courses (constituting a full one term course) at the end of the term were included in the "Pass" category. The subjects who failed or were absent from one or more of the five examinations were included in the "Non-pass" category

Table 1.
Relations between the approach in the experiment, the approach in the normal studies and academic achievement in Education.

Approach in Experiment	Normal studies	Academic achievement	Number of subjects
Atomistic	Atomistic	Non-pass	10
Holistic	Atomistic	-"-	2
Holistic	Holistic	-"-	1
Holistic	Holistic	Pass	9
Atomistic	Holistic	-"-	1
Holistic	Atomistic	-"-	4
Atomistic	Atomistic	-"-	3

Only one subject with a holistic approach in normal studies did not pass all examinations. Three subjects with an atomistic approach in both respects did pass all examinations. Generally it can be said that there was a rather high correspondence between approach and achievement.

The one-year course in Social Sciences taken by our second group of subjects included two courses in each of three subjects, namely Political Science, Economics and Sociology. Our presentation is confined to the two first mentioned subjects. We have categorised the interview data as to holistic-atomistic approach for the two subjects taken separately. The data was more extensive and the indications more clear for this group than for the group in Education (due to more extensive interviews). The relationship between approach and achievement within each of the two academic subjects is given in tables 2 and 3. Subjects

who had passed the two courses at the end of the second course are included in the "Pass" category and those who had not passed one or both of the courses are included in the "Non-pass" category.

Table 2.
Relation between approach and achievement in Political Science.

	Non-pass	Pass
Holistic	2	15
Atomistic	8	4

Table 3.
Relation between approach and achievement in Economics.

	Non-pass	Pass
Holistic	8	10
Atomistic	4	

The relationship between approach and achievement in Political Scinece was very similar to the relationship found in Education. The relationship in Economics was somewhat different. Both in Education and Political Science there were few subjects with a holistic approach who did not pass and somewhat more with an atomistic approach who did pass. Very few subjects seem to have used an atomistic approach in their studies in Economics and those who did so, did not pass any of the examinations. On the other hand, several subjects using a holistic approach in Economics did not pass any of the examinations. Six subjects participated in Political Science but not in Economics. Four of these had an atomistic approach in Political Science. (One more subject is missing in Economics because she did not participate in the interview).

In Education and Political Science a holistic approach does not seem to be necessary but almost "sufficient" for success while in Economics it seems quite necessary but far from "sufficient". However, these results

can not be functionally interpreted without considering the patterns of study.

The patterns of study and their relationship to approach and success is essential for the fourth topic mentioned above (p. 2). The analyses of the patterns of study were made for each course in relation to the examination in such a way that we tried to differentiate those who did not pass from those who passed with regard to the patterns of study. The aspects of pattern of study concidered were: presence during tuition, time spent on home-work, part of the literature read (in number of pages), distribution of work in time, and repetition. The differentiation meant that those who did not pass had to be different from all of those who passed in at least one of the aspects mentioned. Before describing the results from the analyses outlined we wish to mention that we did not find any correspondence between extent and type of such study behaviour as underlining, notations, and summaries and academic achievement.

Most of those in the "Non-pass" category did not sit for the examination. Those who did not sit for an examination could be differentiated from those who passed as to study pattern. This was so in sixteen cases in Education (five courses), nine cases in Political Science(two courses) and nine cases in Economics (two courses). Those who did not participate in the courses are not included. Thus, in these cases there was an adaptation between study patterns and participation in examination.

Among those who failed some could be differentiated from those who passed as to patterns of study and some could not. Nine cases in Education, no case in Political Science and seven cases in Economics could be differentiated. Six cases in Education, four in Political Science and eight in Economics could not be differentiated. As can be seen there were many fails in Economics (only two courses). The conclusion for this part of the investigation is that there was a high correspondence between patterns of study and academic achievement.

Thus, there was a high degree of correspondence between approach and achievement and between patterns of study and achievement. The group of subjects which passed all the examinations had, by definition (by dif-

ferentiating those who did not pass from the passes), superior patterns of study. Most of them - but not all - used a holistic approach. Those who did not pass all the courses had in most cases inferior patterns of study in the courses they did not pass but superior patterns in the courses they passed. This was true in Education and Political Science but not in Economics.

In Economics, four of eight subjects who had a holistic approach and who did not pass the examinations could not be differentiated from those who passed as to patterns of study. One of the four with an atomistic approach could not be differentiated. Although a holistic approach seems to have been more necessary in Economics than in the two other subjects there were also other differences between the individuals of importance in Economics. These were probably differences in knowledge of some general principles central to this subject, (cf Dahlgen, 1975).

In Education and Political Science almost all subjects passed one or more courses. Several subjects with an atomistic approach obtained high points in the courses they passed. Thus for these academic subjects the holistic approach was not necessary for success in a separate course.

In Education and Political Science, the subjects with a holistic approach who did not pass an examination could be differentiated as to patterns of study. Those who failed and could not be differentiated as to patterns of study had an atomistic approach. However, most of those who did not pass had both an inferior pattern of study and an atomistic approach.

What then was the functional relation between the atomistic approach, the patterns of study, and academic achievement. Inferior patterns of study mostly meant less work devoted to the studies together with no preparation for examination. As this was the case, inferior pattern of study is the logical explanation of "non-passed" examinations. Why then did those with an atomistic approach tend so strongly to have inferior patterns of study?

As we have seen, most of the subjects we have discussed passed one or more courses. There was a very great difference between courses so that almost all cases of "Non-pass" were found in later courses in Education and in the second course in Political Science. The courses and examinations taken separately did not demand a holistic approach, but very few of the students using an atomistic approach were successful in their studies as their level of study decreased throughout the term. Their way of learning without understanding was probably too hard and too boring in the long run. Those with an atomistic approach who succeeded were very motivated and very systematic in their work.

We thus found an indirect relationship between approach and academic achievement in that the development of patterns of study was dependent on the approach in learning.

D I S C U S S I O N

The concept of study skill has been used to stress the need for a more integrated and detailed treatment of the area of research dealt with in this paper. The contribution from the knowledge of patterns of study to the interpretation of functional relations between ways of learning and criteria of success was clearly demonstrated. Also the relation between previous knowledge and subsequent learning was revealed through consideration of several aspects of learning. A guiding principle in our research has been the aim to obtain interpretations of functional relations of the data by considering the context. This aim led us to stress the individual as the function unit to be studied.

The view of the problem of research was found to be incompatible with the designs and methods used within the two dominating traditions of research, the correlational and the experimental. The approaches represented by these traditions were found to be too narrow in most cases. They seem to us to be based in most cases, on principles for analysis of data that are incompatible with the nature of the functional relations which are the phenomena being studied. The analysis of data thus gives results which constitute methodological artefacts.

Cronbach (1957) discussed the two traditions referred to and found them too narrow and suggested a combination in a third approach that

would consider variations between both individuals and treatments. Cronbach and Snow (1969) reviewed research of the proposed kind and labeled it ATI-research. This more integrated approach was of course an improvement compared to the two traditional approaches combined.

The research reported within this new approach however, does not seem to be very encouraging. This seems to us to depend on the fact that the approach, by being more integrating and directed towards functional relations, reveals the methodological weaknesses preserved from the old traditions. The approach does not seem to be entirely appropriate for studying functional relations. It does not consider the individual as the functional unit and the dependence of the data on the context. This is the same as saying that the results referred to by the term interaction represent methodological artefacts. We believe that one must use combinations of observations within individuals followed by comparisons of such combinations as the only principle for analysis of data in research aiming at investigating functional relations.

In the investigation presented, we found that two alternative ways of learning represented a very important difference in study skills between subjects. The fundamental difference between the two ways of learning was a difference in approach to the content of the learning material. Two approaches, a holistic and an atomistic, corresponding to two levels of processing were found. Although a holistic approach was not necessary in the normal studies, in the sense that a corresponding level of outcome was necessary in examinations, it was important because of demands from the learning material and the situation.

Both in the learning experiment and in the normal studies a holistic approach was more efficient also when judged by quantitative criteria of knowledge. The difference between these two approaches thus seems important with a rather great variation in both learning material (situation) and criteria.

The importance of the difference between the two approaches in learning is very much supported by the similarity between our results and the results reached by others studying learning of rather different types of material. Such research has been presented by e.g. Wertheimer (1945), Katona (1940), and Marton (1970). Wertheimer (1945) described learning

with and without understanding, with and without command of the structural characteristics of the problem. Katona (1940) contrasted two types of learning - organizing and memorizing. Marton (1970) analysed differences in learning in terms of degree of hierarchic and sequential structure.

In some recent studies of groups of students at colleges and universities, strategies of learning very similar to our approaches have been found. Biggs (1970 a, b; 1973) found two strategies, a "reproductive, where the student gives back prescribed material intact" and a "transformational where the student ranges widely over material and injects his own meaning and interpretations". Goldman and his colleborators (Goldman, 1972; Goldman and Warren, 1973; Goldman and Hudson, 1973) also found two dominating strategies in several studies. One in which the student uses formal reasoning and active integration and one in which the student memorizes material and techniques without understanding them.

In the studies mentioned, the learning strategies have been related to criteria of success. The relationships found (as measured within the correlational tradition) are rather weak. It is hard to interpret the relationships for several reasons. Patterns of study have not been considered. The methods used do not, according to our view, give the most appropriate basis for interpretations of functional relations. The criteria used are also different from our (grades and not pass-fail as in our case) which, according to our results, ought to give a levelled out and weaker relation.

The relation between strategies and criteria of academic achievement have also been compared in different major fields and academic subjects. Somewhat different results (in some cases even "contradictory") were obtained in different investigations. The authors themselves point out differences in methods and in specific factors as possible explanations for the results. To reveal how a strategy varies, depending on learning material and context and how this variation is related to other aspects of the study activities and to academic achievement, would in our opinion, be very interesting.

Thus the main difference between the two approaches to learning ma-

terial found in our investigation seem to be well established for many academic subjects. To reveal the functional relationships between these approaches and criteria of success, an analysis of the meaning of the relationship in different contexts seems to be needed. We have proposed the concept of study skill as defined here and a methodological rationale compatible with this concept as an appropriate approach for further research within this field.

REFERENCES

Biggs, J.B. Faculty patterns in study behaviour. Australian Journal of Psychology. 1970, 22, 161-174. (a).

Biggs, J.B. Personality correlates of certain dimensions of study behaviour. Australian Journal of Psychology. 1970, 22, 287-297. (b).

Biggs, J.B. Dimension of study behaviour: Another look at ATI. Paper presented at the Annual Conference of the Australian Association for Research in Education, Sydney, 9-11 November, 1973.

Cronbach, L.J. The two disciplines of scientific psychology. American Psychologist, 1957, 12, 671-684.

Cronbach, L.J. & Snow, R.E. Individual differences in learning ability as a function of instructional variables. School of Education, Stanford University, 1969.

Dahlgren, L.O. On non-verbatim learning: Level of outcome as a function of level of processing. I. Some effects of explicit control. Paper presented at this symposium, 1975.

Goldman, R.D. Effects of a logical versus a mnemonic learning strategy on performance in two undergraduate psychology classes. Journal of Educational Psychology, 1972, 63, 347-352.

Goldman, R.D. & Warren, R. Discriminant analysis of study strategies connected with college grade success in different major fields. Journal of Educational Measurement, 1973, 10, 39-47.

Goldman, R.D. & Hudson, D.J. A multivariate analysis of academic abilities and strategies for successful and unsuccessful college students in different major fields. Journal of Educational Psychology, 1973, 65, 364-370.

Katona, G. Organizing and memorizing. New York: Columbia University Press, 1940.

Kerlinger, F.N. Foundations of behavioral research. New York: Holt, Rinehart and Winston, 1973.

Marton, F. Structural dynamics of learning. Stockholm: Almqvist & Wiksell, 1970.

Marton, F. Some effects of content-neutral instructions on non-verbatim learning in a natural setting. Scandinavian Journal of Educational Research, 1974, 18, 199-208.

Marton, F. On non-verbatim learning: II. The erosion effect of a task-induced learning algorithm. Reports from The Institute of Education, University of Göteborg, no 40, 1975.

Marton, F. Non-verbatim learning: Level of processing and level of outcome. Paper presented at this symposium, 1975.

Schwartz, P.A. Prediction instruments for educational outcomes. In Thorndike, R.L. Educational measurement (second ed.). Washington: American Council on Education, 1971.

Svensson, L. Study skills and learning. (Manuscript), 1975.

Säljö, R. Non-verbatim learning: Level of outcome as a function of level of processing. II. Some effects of anticipated test requirements. Paper presented at this symposium, 1975.

Wertheimer, M. Productive thinking. New York; Harper & Row, 1945.

Reports from the Institute of Education, University of Göteborg

1. Andersson, Bengt-Erik o. Nilsson, S-G: An application of the critical incident technique to the study of job and training requirements of shop managers, June 1962.

2. Bullock, Donald H.: Research in programmed learning. Description of and Rationale for a Program of Experimental Analysis. November 1965.

3. Härnqvist, Kjell: Social Factors and Educational Choice. 1965.

4. Härnqvist, Kjell: Relative changes in intelligence from 13 to 18. December 1967.

5. Dahllöf, Urban o. Lundgren, Ulf P.: A project concerning macromodels for the curriculum process, A short presentation, Project COMPASS 12. April 1969.

6. Andersson, Bengt-Erik: PROJECT YG (Youth in Göteborg) - A presentation of background, design, instruments and populations. Project UG 9. June 1969.

7. Dahllöf, Urban: Ability grouping, content validity and curriculum process analysis. Project COMPASS 13. June 1969.

8. Dahllöf, Urban: Research on oral examination within the International Baccalaureats: Some general points of view and some inferences from the psychology of Interviewing. Project COMPASS 20. January 1970.

9. Dahllöf, Urban: The materials and methods of implementation in the development of the curriculum, Outline of a model and some illustrations from Sweden. Paper read at the Conference of Comparative Education Society in Europe, Praque June 1969. Project COMPASS 21. Januari 1970.

10. Dahllöf, Urban o. Lundgren, Ulf P.: Macro and micro approaches combined for curriculum process analysis: A Swedish educational field project. Paper read at the annual meeting of the American Educational Research Association in Minneapolis, March 2-6, 1970. Project COMPASS 23. April 1970.

11. Andersson, Bengt-Erik: Actual and perceived attitudes among adolescents and adults towards each other. A study of a group of Swedish teenagers and their parents. The Stug-project 3. April 1971.

12. Andersson, Bengt-Erik: Parental and peer influences and adolescent peer orientation. Project UG 12. April 1971.

13. Andersson, Bengt-Erik o. Ekholm, Mats: The generation gap. Frame of reference and design of the Stug-Project. The Stug-project 4. May 1971.

14. Andersson, Bengt-Erik o. Ekholm, Mats: Swedish Youth of To-day, Description of a Research Project About the Generation Gap. Paper presented to the International conference on "Sozialization Processes In the Contemporary European Youth" in Bratislava June 14-17, 1971. The Stug-project 5. June 1971.

15. Marton, Ference o. Sandqvist, Gjertrud: Learning while typing. TIPS 3. September 1971.

16. Dahllöf, Urban; Lundgren, Ulf P o. Siöö, Margareta: Reform implementation studies as a basis for corriculum theory: Three Swedish approaches. Reprint from curriculum Theory Network 7, 1971: Monograph Supplement: Elements of Curriculum Development, edited by F. Michael Connelly with the assistance of John Herbert and Joel Weiss. Project COMPASS 39. December 1971.

17. Lundgren, Ulf P: An empirical study of the teaching process. Theory, design and methodology. Project COMPASS 40. January 1972.

18. Härnqvist, Kjell: Training and career structure of educational researchers. Reprint of paper read at Colloquium of Directors of Educational Research Organizations, London 10-12 November 1971, arranged by Council of Europe. March 1972.

19. Härnqvist, Kjell: Canonical analyses of mental test profiles. Project MID 2. April 1972.

20. Härnqvist, Kjell and Bengtsson, Jarl. Educational reforms and educational equality. Contribution to a Reader on Social Stratification edited by Scase. April 1972.

21. Bradley, Gunilla: Women's interest in promotion in relation to job satisfaction and home and school background. September 1972.

22. Åsberg, Rodney: An attempt at a Pedagogical Evaluation of the Development Studies in Lund 1969-70; Housing, Building and Planning. May 1971.

23. Marton, Ference; Fransson, Anders; Jonsson, Barbro Klenell; Ann-Charlotte o. Roos, Birgitta. Differential effects of stress-including instructions on anxiety. TIPS 7. October 1972.

24. Lundgren, Ulf P.: Educational Process Analysis. Two articles. Project COMPASS 48. November 1972.

25. Lundgren, Ulf P.: Pedagogical frames and the teaching process. A report from an empirical curriculum project. Paper read at the AERA meeting in New Orleans 26 Feb - 1 March 1973. Project COMPASS 51. February 1973.

26. Andrae, Annika: Late-bloomers and alternative courses of study at the senior level of the compulsory comprehensive school and qualification for academic education at the upper secondary level. Project COMPASS 54. February 1973.

27. Lundgren, Ulf P.: Pedagogical roles in the classroom. A contribution to Eggleson, J. 1973: Contemporary Research in the

28. Andersson, Bengt-Erik: The Generation Gap - Imagination or Reality? Paper presented to the biennal meeting of the International Society for the Study of Behavioral Development. The Stug-project 21. May 1973.

29. Andersson, Bengt-Erik: Project YG (Youth in Göteborg) - A study of a group of Swedish urban adolescents. Project UG 13. June 1973.

30. Dahllöf, Urban: Data on curriculum and teaching process: Do they make any difference to non-significant test differences - and under what conditions? Address to division B of the American Educational Research Association, Feb 27, 1973. Project COMPASS 60. August 1973.

31. Andrae, Annika and Dahllöf, Urban: Process Analysis of Non-Graded Rural Schools in Sweden, Outline of an Evaluation Project. Project PANG 5. February 1973.

32. Lundgren, Ulf P. o. Wallin, Erik: Some Notes on Education as a Science. September 1973.

33. Norvell, Bo: The Class Size and the Teaching Process. Part I. October 1973.

34. Härnqvist, Kjell: Individual differences in higher education: Selection or adaption? Plenary lecture at the Congress on Methodology of Research in Higher Education, Rotterdam, 3-5 December 1973. Project MID 9. December 1973.

35. New Trends in Evaluation. Report from a conference on educational evaluation with an introductory paper by Professor Robert E. Stake, University of Illinois. January 1974.

36. Gustafsson, Jan-Eric: Verbal versus Figural in Aptitude-Treatment Interactions. Review of the literature and an empirical study. Project MID 10. March 1974.

37. Lindblad, Sverker: Simulation and guidance. Experiences from planning and evaluation teaching with simulation designed for grade 6 in Swedish compulsory schools. Project-group UPIM 24. April 1974.

38. Gustafsson, Jan-Eric: Implications of interactions for the experimental research on teaching methods. Project MID 12. June 1974.

39. Marton, Ference: On non-verbatim learning: I. Level of processing and level of outcome. Project TIPS 13. January 1975.

40. Marton, Ference: On non-verbatim learning: II. The erosion effect of a task-induced learning algorithm. Project TIPS 14. January 1975.

41. Marton, Ference and Dahlgren, Lars Owe: On non-verbatim learning: III. The outcome space of some basic concepts in economics. Project TIPS 15. January 1975.

42. Marton, Ference: On non-verbatim learning: IV. Some theoretical and methodological notes. Project TIPS 16. January 1975.

43. Lundgren, Ulf P.: Analyse von curriculum prozessen - der engere ansatz: Curriculum prozess als instruktionsgeschehen. Research report from the MAP-group 1975:1. January 1975.